4-16
Brief
C. Taylor
8/1/03

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of	
Joel L. PASSKE, et al.	Group Art Unit: 3728
Serial Number 09/887,523	Examiner: Stashick, A.
Filed: June 21, 2001	Attorney Reference: 005127.00094
For: FOOTWEAR WITH BLADDER FILTER	

APPEAL BRIEF

Commissioner for Patents
U.S. Patent and Trademark Office
Alexandria, VA 22313

Sir:

Appellants hereby appeal to the Board of Patent Appeals and Interferences from the decision of the Primary Examiner finally rejecting claims 1-16 in the above-captioned patent application.

(1) Real Party In Interest

The real party in interest is Nike, Inc., a corporation organized and existing under the laws of the State of Oregon in the United States of America, and having its principal place of business at One Bowerman Drive, Beaverton, Oregon 97005.

(2) Related Appeals and Interferences

Appellants and the legal representative of the Appellants are unaware of any appeals or interferences related to the subject appeal.

(3) Status of Claims

Claims 1-16 (reproduced for reference in Appendix A) are pending in the application, with claims 1 and 9 being independent claims. The following claim rejections were made in the Office Action of February 26, 2003:

(a) Claims 1-16 were rejected under 35 U.S.C. §103 as being unpatentable over a combination of U.S. Patent Number 5,845,417 to Reed et al. (hereafter referred to as Reed) and European Patent Application Number 1,074,193 to Opal Limited (hereafter referred to as Opal); and

(b) Claims 1-14 and 16 were rejected under 35 U.S.C. §103 as being unpatentable over a combination of French Patent Application Number 2,670,369 to Colesnicenco Niculae (hereafter referred to as Colesnicenco) and Opal.

Each of the references cited in the rejections are included in Appendices B-D.

None of the pending claims have been allowed, and Appellants hereby appeal each rejection of the pending claims (i.e., claims 1-16).

(4) Status of Amendments

No amendments have been made to the claims subsequent to the Office Action of February 26, 2003.

(5) Summary of Invention

In various embodiments of the invention, an article of footwear includes a fluid system to either pressurize a cushioning bladder or ventilate the interior of an upper portion of the footwear. The fluid system incorporates a filter to prevent particulates and liquids, such as water, from entering the fluid system. As discussed in greater detail below, particulates and fluids that enter the fluid system may have a detrimental effect upon the operation of the fluid system.

With reference to the Figures provided in Appendix E, the article of footwear (Figures 1 and 2, element 100) includes an upper (Figures 1 and 2, element 110) and a sole structure (Figures 1 and 2, element 120). The sole structure further includes an insole (Figure 2, element 121), a midsole (Figure 2, element 122), and an outsole (Figure 2, element 123). In addition to the upper and the sole structure, the footwear includes a fluid system having a filter structure

(Figures 1-3, 5A, and 5B, element 130), first and second conduits (Figures 2 and 3, elements 140 and 170), first and second valves (Figures 2 and 3, elements 150 and 180), a pump (Figures 2 and 3, element 160), and a bladder (Figures 1-3, element 190).

The filter structure permits air to enter the first conduit, but restricts the entry of liquids and particulates. The first conduit, which may include the first valve, places the filter structure in fluid communication with the pump. The second conduit, which may include the second valve, places the pump in fluid communication with the bladder. Accordingly, air may pass through the filter structure and, through the action of the various components, the air may enter and pressurize the bladder (page 6, line 22 through page 7, line 5).

In operation, the pump is compressed by the weight of a wearer when the footwear is in contact with ground. As the footwear disengages from the ground, the pump returns to an uncompressed configuration, thereby drawing air through the filter structure and into the first conduit. The air then passes through the first valve and enters the pump. When the footwear again makes contact with the ground, the force of the wearer's body compresses the pump and increases the pressure of the air within the pump. Due to the increased pressure, air is forced into the second conduit, passes through the second valve, and enters the bladder. In this manner, the bladder receives ambient air through the filter structure and is pressurized (page 7, lines 6-23).

The filter structure prevents water, other liquids, and a variety of particulates from entering the fluid system and disrupting operation of the various fluid system components. If particulates were permitted to enter the fluid system, for example, the particulates could collect in the first valve and prevent the first valve from closing properly, thereby allowing air to freely return from the pump to the filter structure and escape to the atmosphere. In addition, water and particulates could collect in the bladder and become visible from the exterior of the footwear, thereby decreasing the aesthetic properties of the footwear. If water were permitted to enter the bladder or other portions of the fluid system, the weight of the footwear may be increased significantly. Furthermore, particulates may act as an abrasive that wears away portion of the system, thereby decreasing durability. Accordingly, the filter structure acts to prevent the entry of liquids and particulates that may have a detrimental effect upon the fluid system (page 8, line 15 through page 9, line 3).

The filter structure may have a variety of configurations. In general, however, the filter structure includes a filter (Figures 2, 3, 5A, and 5B, element 134), which provides a semi-porous

medium through which ambient air passes in order to enter the first conduit and, thereafter, the bladder (page 9, line 4 through page 10, line 7). Suitable materials for the filter include polytetrafluoroethylene (PTFE) or expanded polytetrafluoroethylene (ePTFE) that is disposed on a substrate material. PTFE and ePTFE exhibit the required characteristics and are suitably durable when attached to a substrate such as non-woven polyester. In addition, other suitable materials for the filter include high-density polyethylene, ultrahigh molecular weight polyethylene, polyvinylidene fluoride, polypropylene, and certain ceramic filter materials (page 12, line 19 through page 13, line 4).

The general concepts discussed above may be applied to fluid systems having different configurations. For example, an article of footwear (Figure 6, element 100a) may have a filter (Figure 6, element 134a) that is attached to an upper surface of a pump (Figure 6, element 160a) such that air from within an upper (Figure 6, element 110a) may pass through the filter and enter the pump. (page 17, line 14 through page 18, line 6) In addition, the concepts may be applied to a ventilation system. A filter (Figure 7, element 230) permits air to flow into a first conduit (Figure 7, element 240) and, thereafter, into a plurality of ventilation conduits (Figure 7, elements 290) that lead to the interior of an upper (Figure 7, element 210). A plurality of filters (Figure 7, elements 230') covers the ends of the ventilation conduits to prevent liquids and particulates from entering the fluid system. As with other configurations, the filters (elements 230 and 230') prevent liquids and particulates from entering the fluid system (page 18, lines 7-19).

In general, therefore, the invention relates to an article of footwear for receiving a foot of a wearer. The article of footwear includes an upper for covering at least a portion of the wearer's foot, a sole structure attached to the upper, and an air-filled bladder in fluid communication with ambient air and attached to the article of footwear. In addition, the footwear includes a filter in fluid communication with the bladder and the ambient air, the filter being structured to permit ambient air to enter the bladder and restrict liquids and particulates from entering the bladder. A variety of materials are suitable for the filter, and the filter may be a polytetrafluoroethylene filter.

(6) Issues

The following issues are presented to the Board of Patent Appeals and Interferences for consideration in this appeal:

(a) Whether a proper motivation exists to combine Reed with Opal in the rejection of claims 1-16;

(b) Whether a proper motivation exists to combine Colesnicenco with Opal in the rejection of claims 1-14 and 16;

(c) Whether each element recited in claim 4 is disclosed in the references; and

(d) Whether each element recited in claims 5 and 11 is disclosed in the references.

(7) Grouping of Claims

The following listing contains groups of claims that stand or fall together in the indicated groups:

(a) Group 1 - Claims 1-3, 6-10,12-14, and 16;

(b) Group 2 - Claim 4;

(c) Group 3 - Claims 5 and 11; and

(d) Group 4 - Claim 15.

Separate reasons are set forth below with respect to each group of claims.

(8) Argument

First Issue - No Proper Motivation to Combine Reed and Opal

Independent claim 1, and dependent claims 2-8, recite an article of footwear having an upper, a sole structure, a bladder, and "a filter in fluid communication with said bladder and ambient air, said filter being structured to permit ambient air to enter said bladder and restrict liquids and particulates from entering said bladder." Additionally, independent claim 9 and dependent claims 10-16, recite a similar structure wherein the filter is a PTFE filter. The claims at issue recite, therefore, a filter that restricts liquids and particulates from entering the bladder.

To establish a *prima facie* case of obviousness, the burden is upon the Examiner to demonstrate reasons why a skilled artisan, confronted with the same problem as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed. *In re Rouffet*, 149 F.3d 1350, 1357, 47

U.S.P.Q.2d 1453, 1458 (Fed. Cir. 1998). Accordingly, obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching, suggestion, or incentive supporting the combination. *In re Geiger*, 815 F.2d 686, 688, 2 U.S.P.Q.2d 1276, 1278 (Fed. Cir. 1987). Furthermore, if the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon* 733 F.2d 900, 902, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984). With regard to the present issue, the Examiner has not properly established the *prima facie* case of obviousness because no proper motivation exists to combine Reed with Opal, as detailed below.

Reed discloses multiple embodiments of a ventilated shoe having a fluid system that includes a filter in fluid communication with a pump. In general, the fluid system draws air and moisture from the interior of the upper and discharges the air and moisture to the exterior of the upper. Although specific information regarding the structure of the filter is not provided, Reed states that "[m]oisture and liquid, along with air, may be drawn through the filter 214 and into the pump cell" (Reed, column 8, lines 48-49). In addition, Reed states that "air is drawn through the filter and into the inlet of intake tube 258. The air and/or liquid then passes through intake valve 264 and through the monotube 260 into the pump cell 254" (Reed, column 10, lines 4-7). The filter disclosed in Reed expressly permits, therefore, the passage of liquids.

In discussing conventional insoles, Reed states "it is very difficult to remove moisture and the odor produced as a result of moisture which collects in the shoe due to foot sweating caused by poor shoe ventilation. Since most people use their shoes for long periods of time, it is essential to properly maintain and ventilate the shoes in order to avoid foot diseases, such as, for example, water-eczema" (Reed, column 1, lines 24-30). One would appreciate, therefore, that a beneficial attribute of the system disclosed in Reed is the capacity for liquids to pass through the filter, thereby removing the liquids from the area surrounding the foot.

Opal discloses an article of footwear having an upper with an arch portion. As stated in Opal, "[a] plurality of openings (24) are located in the arch portion (18)....A waterproof, breathable membrane (26) larger than the area of the openings (24) is secured to the upper part (16) across the openings" (Opal, column 3, lines 28-40). Furthermore, the "waterproof and breathable membrane is sandwiched between the inside and outside surfaces in the arch portion

of the upper part..." (Abstract). The membrane may be formed of a material such as Gore-Tex®, which includes polytetrafluoroethylene, otherwise referred to as PTFE.

Modifying the fluid system disclosed in Reed to incorporate the material disclosed in Opal would impermissibly render Reed unsatisfactory for its intended purpose. As discussed in detail above, the fluid system disclosed in Reed expressly permits liquids to pass through the filter, thereby removing the liquids from the area surrounding the foot. In order to accomplish the removal of liquids, "[m]oisture and liquid, along with air, may be drawn through the filter 214 and into the pump cell" (Reed, column 8, lines 48-49). The rejection of claims 1-16 states that "it would have been obvious, to one of ordinary skill in the art at the time the invention was made, to make the filter of Reed et al. '417 out of Gore-Tex®, as taught by Opal '193..." (Office Action dated February 26, 2003, page 2, lines 24-26). Utilizing the material disclosed in Opal, as proposed in the rejection, would effectively prevent the passage of liquids in the fluid system of Reed, thereby limiting the degree to which water may be removed from the area surrounding the foot. Combining Reed with Opal would, therefore, render Reed unsatisfactory for its intended purpose of removing liquids, such as water.

With reference to providing motivation, the Examiner asserted in page 4 of the Office Action dated February 26, 2003 that "Opal is designed to allow for the passage of water vapor through the material in which it is made, thereby allowing for the passage of liquid that has been heated by the foot to pass through the material as a vapor." The Examiner contends, therefore, that the Gore-Tex® material of Opal does permit the passage of liquid, in as far as the liquid is a vapor. Appellants respectfully submit, however, that liquid and vapor are two separate and distinct states of matter. One of ordinary skill would not be motivated, therefore, to modify Reed to include the Gore-Tex® material of Opal if an express attribute of the filter in Reed is to permit the passage of liquid. That is, one of ordinary skill in the art would not utilize a material that only permits the passage of vapor in an application that expressly involves a filter material that permits the passage of liquid, even if the liquid may be converted to vapor through heating by the foot.

For the reasons discussed above, modifying the fluid system disclosed in Reed to incorporate the material disclosed in Opal would render Reed unsatisfactory for its intended purpose of removing liquids. Accordingly, the Primary Examiner has not properly established

the *prima facie* case of obviousness because no proper motivation exists to combine Reed with Opal in the rejection of claims 1-16.

Second Issue - No Proper Motivation To Combine Colesnicenco and Opal

Colesnicenco discloses a fluid system that may be incorporated into an article of footwear for ventilating the interior of the footwear. A professionally prepared translation of Colesnicenco is enclosed with this Appeal Brief. Referring to page 3, lines 20-22 of the Colesnicenco translation, Colesnicenco teaches that the air filter consists of "a filtering material (1b) such as felt or another filtering material." Felt is recognized as a cloth made of wool and fur often mixed with natural or synthetic fibers, or felt may be a firm woven cloth of wool or cotton heavily napped and shrunk. *Merriam-Webster's Collegiate Dictionary*, Tenth Edition, 2000.

The recommendation that "felt or another filtering material" be utilized as the filter material in Colesnicenco does not teach or suggest the use of a filter that is structured to restrict the passage of liquids through the filter material. To overcome this deficiency, the rejection combines Colesnicenco with Opal. The mere fact that references can be combined or modified, however, does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990). In this matter, the rejection presents no line of reasoning as to why a person skilled in the relevant art, when reviewing only the collective teachings of the references, would have found it obvious to selectively pick and choose various elements and/or concepts from the references to arrive at the claimed invention. In other words, the rejection does little more than cite Colesnicenco and Opal to show that one or more elements, when each is viewed in a vacuum, may be known.

As discussed with respect to the First Issue, the burden is upon the Examiner to demonstrate reasons why the skilled artisan, confronted with the same problem as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed. *In re Rouffet*, 149 F.3d 1350, 1357, 47 U.S.P.Q.2d 1453, 1458 (Fed. Cir. 1998). In this case, however, the Examiner has made no such showing, but instead has simply asserted that the combination may be made. This assertion, however, is not supported by the references. Whereas Colesnicenco teaches a fluid system for mechanically-ventilating footwear that incorporates conduits, pumps, and valves to forcefully

transfer air, Opal merely teaches the diffusion of air from the interior of the footwear to the exterior, and vice-versa, through the Gore-Tex® material. The fact that Gore-Tex may be utilized in footwear is not sufficient to suggest to one skilled in the art that the Gore-Tex material may be given a specialized purpose in a complex mechanical system that pumps air into the upper. Neither Colesnicenco nor Opal incorporate a teaching or suggestion that would motivate one skilled in the relevant art to make the combination suggested in the rejection.

The claims at issue recite a filter that restricts liquids and particulates from entering the bladder. Opal, however, merely teaches using Gore-Tex® in an upper of an article of footwear. More particularly, Opal teaches using Gore-Tex® as a portion of the upper to permit air transfer between the interior and the exterior of the footwear, while preventing liquid water from passing through the upper. Opal does not teach, therefore, Gore-Tex® material as a filter. Colesnicenco, however, teaches a mechanical ventilation system includes a filter material.

When determining the patentability of a claimed invention that combines two known elements, the question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination. *In re Rouffet*, 149 F.3d 1350, 1355, 47 U.S.P.Q.2d 1453, 1456 (Fed. Cir. 1998). With respect to the present matter, the rejection merely combines the material of Opal with the system disclosed Colesnicenco. More particularly, the rejection utilizes a material that is incorporated into an upper of an article of footwear in combination with a complex mechanical system for ventilating another article of footwear. The rejections do not, however, provide any reasoning as to how the prior art suggests the desirability of combining the references and has, therefore, failed to establish a *prima facie* case of obviousness.

For the reasons discussed above, there is no suggestion or motivation to make the proposed modification of Colesnicenco with the material disclosed in Opal. Accordingly, the Examiner has not properly established the *prima facie* case of obviousness in the rejection of claims 1-14 and 16.

Third Issue - Elements Of Claim 4 Are Not Disclosed

Claim 4 recites that the filter includes one of the group consisting of high-density polyethylene, ultrahigh molecular weight polyethylene, polyvinylidene fluoride, polypropylene, and ceramic filter materials. To establish a *prima facie* case of obviousness, the burden is upon

the Examiner to demonstrate that the prior art references teach or suggest all the claim limitations. That is, all of the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981 (C.C.P.A. 1974). Neither Reed, Colesnicenco, nor Opal disclose any of the filter materials recited in claim 4. Furthermore, the Office Action fails to even suggest that the materials recited in claim 4 are disclosed in the references. The rejections of claim 4 have, therefore, failed to establish a *prima facie* case of obviousness.

Fourth Issue - Elements Of Claims 5 and 11 Are Not Disclosed

Claims 5 and 11 recite that the filter is hydrophobic and oleophobic. The rejections, however, fail to address the limitations of claims 5 and 11. As stated above, to establish a prima facie case of obviousness of a claimed invention, all of the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981 (C.C.P.A. 1974). Neither Reed, Colesnicenco, nor Opal disclose hydrophobic and oleophobic properties of a filter. Furthermore, the Office Action fails to even suggest that the filter materials disclosed in the references may be hydrophobic and oleophobic. The rejections of claims 5 and 11 have, therefore, failed to establish a *prima facie* case of obviousness.

Conclusion

The rejections submitted in the Office Action of February 26, 2003 should be reversed for at least the reasons recited above. Allowance of claims 1-16 is, therefore, respectfully requested.

In accordance with 37 C.F.R. §1.192, Appellants submit this Appeal Brief in triplicate to the Board of Patent Appeals and Interferences. A Notice of Appeal was timely filed on May 23, 2003.

Filed concurrently herewith is a Fee Transmittal, a Request For Oral Hearing, and a Petition For Extension Of Time. The Fee Transmittal authorizes the Commissioner to charge a fee of:

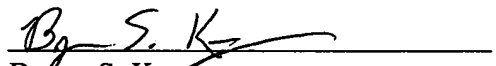
(a) $320.00 for the filing of this Appeal Brief;

(b) $280.00 for the Request For Oral Hearing; and

(c) $110.00 for the Petition For Extension Of Time.

It is believed that no additional fees are due in connection with this Appeal Brief. Should additional fees be deemed necessary, however, such fees are hereby requested and the Commissioner is authorized to charge deposit account number 19-0733 for the payment of the requisite fee.

Respectfully submitted,



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Dated: July 25, 2003

Appendix A
Claims Involved in the Appeal

1. An article of footwear for receiving a foot of a wearer, said article of footwear comprising:

an upper for covering at least a portion of the wearer's foot;

a sole structure attached to said upper;

an air-filled bladder in fluid communication with ambient air and attached to said article of footwear; and

a filter in fluid communication with said bladder and ambient air, said filter being structured to permit ambient air to enter said bladder and restrict liquids and particulates from entering said bladder.

2. The article of footwear of claim 1, wherein said filter includes polytetrafluoroethylene.

3. The article of footwear of claim 2, wherein said polytetrafluoroethylene is expanded polytetrafluoroethylene.

4. The article of footwear of claim 1, wherein said filter includes one of the group consisting of high density polyethylene, ultrahigh molecular weight polyethylene, polyvinylidene fluoride, polypropylene, and ceramic filter materials.

5. The article of footwear of claim 1, wherein said filter is hydrophobic and oleophobic.

6. The article of footwear of claim 1, wherein a perforated layer is located over said filter, said perforated layer permitting air to access said filter.

7. The article of footwear of claim 6, wherein said perforated layer prevents large particles and objects from contacting said filter.

8. The article of footwear of claim 1, wherein said bladder is located in said sole structure.

9. An article of footwear for receiving a foot of a wearer, said article of footwear comprising:

an upper for covering at least a portion of the wearer's foot;

a sole structure attached to said upper;

an air-filled bladder in fluid communication with ambient air and attached to said article of footwear; and

a polytetrafluoroethylene filter in fluid communication with said bladder and ambient air, said filter being structured to permit ambient air to enter said bladder and restrict liquids and particulates from entering said bladder.

10. The article of footwear of claim 9, wherein said polytetrafluoroethylene is expanded polytetrafluoroethylene.

11. The article of footwear of claim 9, wherein said filter is hydrophobic and oleophobic.

12. The article of footwear of claim 9, wherein a perforated layer is located over said filter, said perforated layer permitting air to access said filter.

13. The article of footwear of claim 12, wherein said perforated layer prevents large particles and objects from contacting said filter.

14. The article of footwear of claim 9, wherein said bladder is located in said sole structure.

15. The article of footwear of claim 14, wherein said filter is located in said sole structure.

16. The article of footwear of claim 14, wherein said filter is located in said upper.

Appendix B
U.S. Patent Number 5,845,417 to Reed et al.

US005845417A

United States Patent [19]

Reed et al.

[11] Patent Number: 5,845,417

[45] Date of Patent: Dec. 8, 1998

[54] **AIR COOLED SHOE HAVING AN AIR EXHAUST PUMP**

[75] Inventors: **Rusty Allen Reed**, Grand Prairie, Tex.; **Mark D. Murrell**, 424 Halifax, Coppell, Tex. 75243

[73] Assignees: **Rusty A. Reed**, Grand Prairie; **Mark D. Murrell**, Coppell, both of Tex.

[21] Appl. No.: **517,877**

[22] Filed: **Aug. 3, 1995**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 325,678, Oct. 19, 1994, abandoned, and a continuation of Ser. No. 648,861, May 6, 1996, Pat. No. 5,697,170.

[51] **Int. Cl.**[6] **A43B 7/06**

[52] **U.S. Cl.** ..... **36/3 B**; 36/3 R

[58] **Field of Search** ..... 36/29, 3 R, 3 A, 36/3 B

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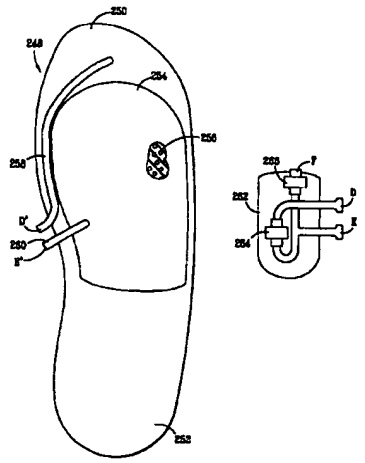
Primary Examiner—B. Dayoan

Attorney, Agent, or Firm—Mark W. Handley; Gregory M. Howison; Joe H. Shallenburger

[57] **ABSTRACT**

A ventilated shoe for ventilating the foot contains an outer sole (**204**). A heel pad (**206**) is disposed at the rear end of the outer sole (**204**). An intake tube (**228**) is disposed near the front of the outer sole (**204**). The intake tube (**228**) is connected to pump cell (**210**). An exhaust tube (**234**) is also connected to pump cell (**210**). An intake valve (**242**) is disposed along the intake tube (**228**) and an exhaust valve (**244**) is disposed along the exhaust valve (**244**). The intake valve (**242**) only allows air to flow through to the pump (**210**). The exhaust valve (**244**) only allows air to flow out of the pump cell (**210**). The pump cell (**210**) is filled with an open-celled foam (**212**) so that when no pressure is being applied to the pump cell (**210**), it draws air in through the intake tube (**228**). When pressure is applied to the pump cell (**210**), the open-celled foam (**212**) is compressed and the air is expelled through the exhaust tube (**234**).

11 Claims, 10 Drawing Sheets



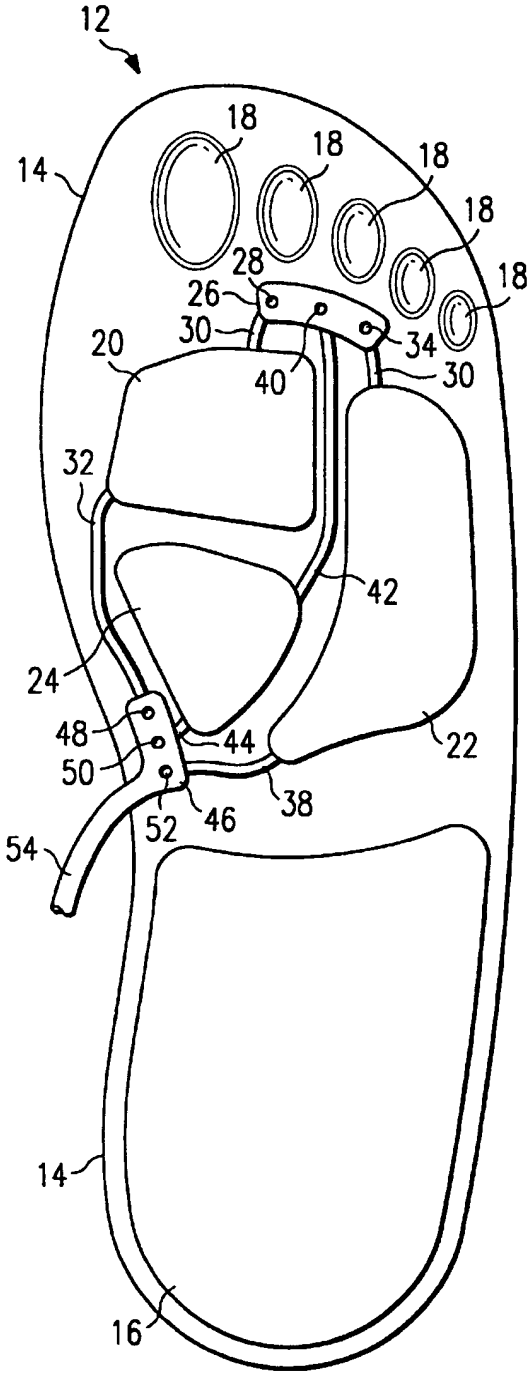

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FIG. 1a

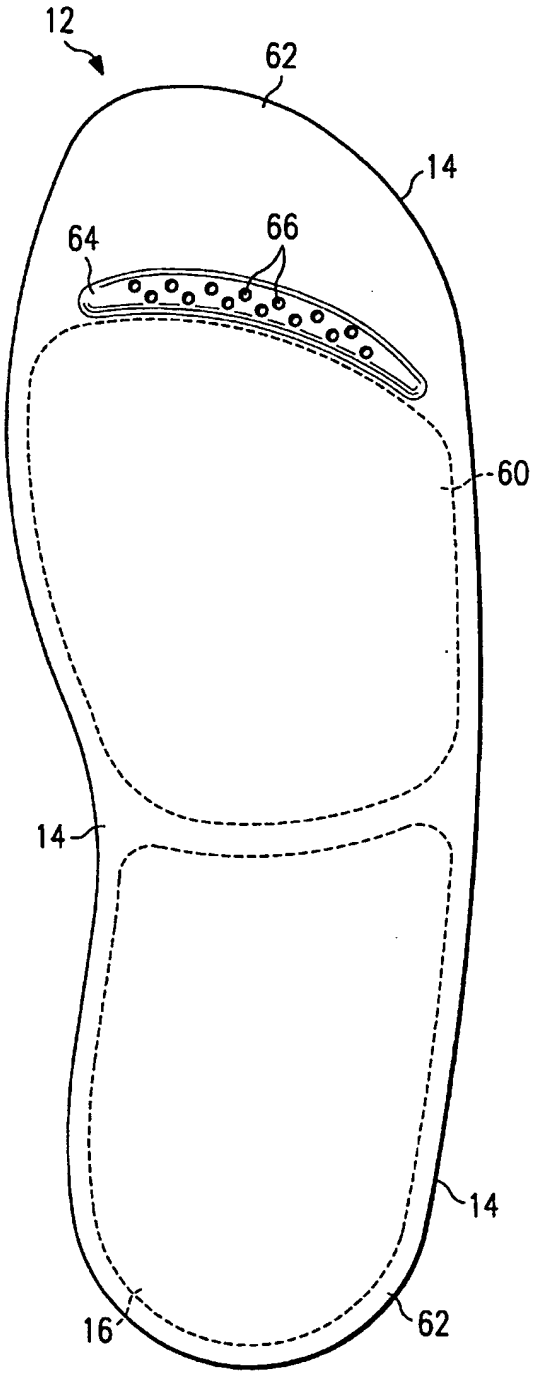
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FIG. 1b

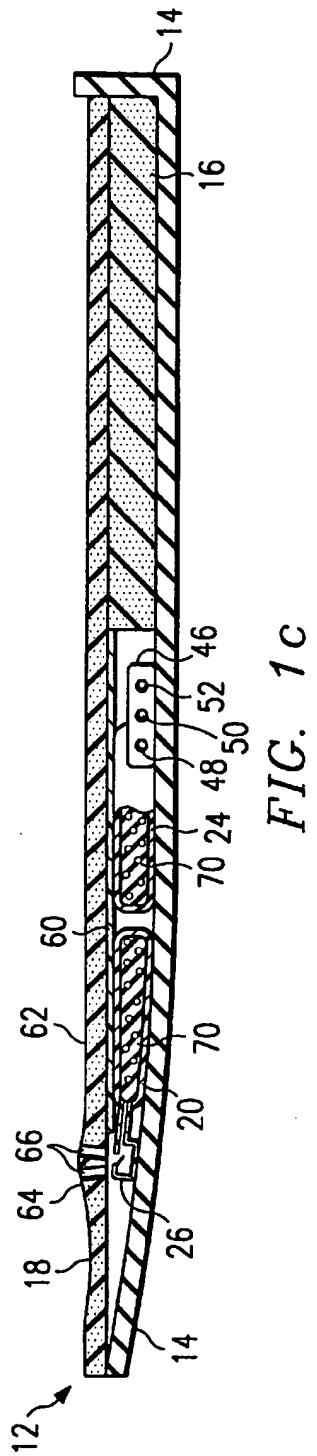

FIG. 1c

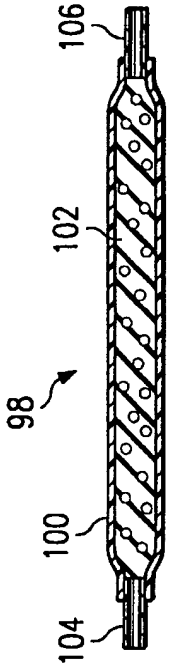

FIG. 2b

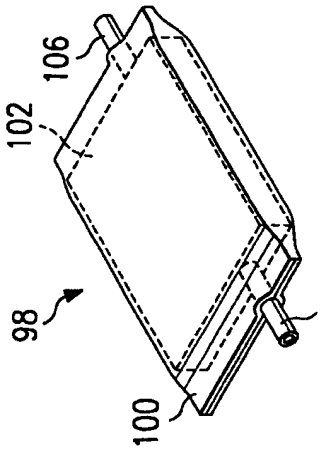

FIG. 2c

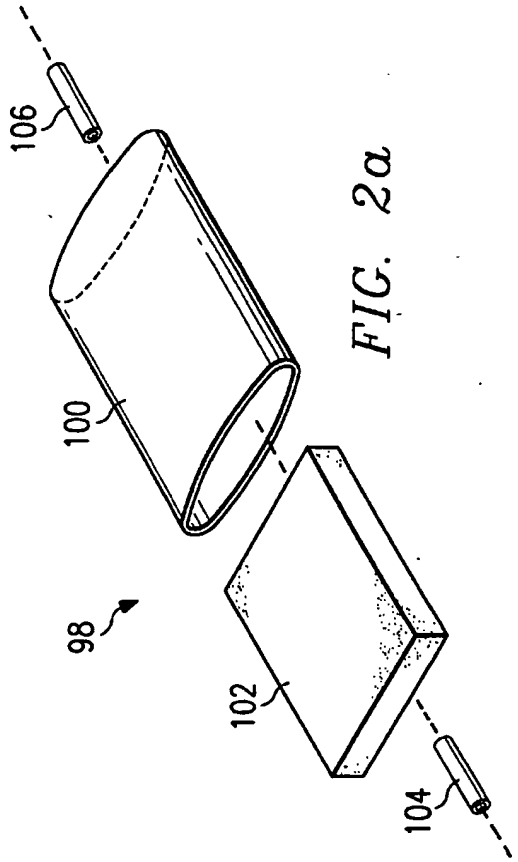

FIG. 2a

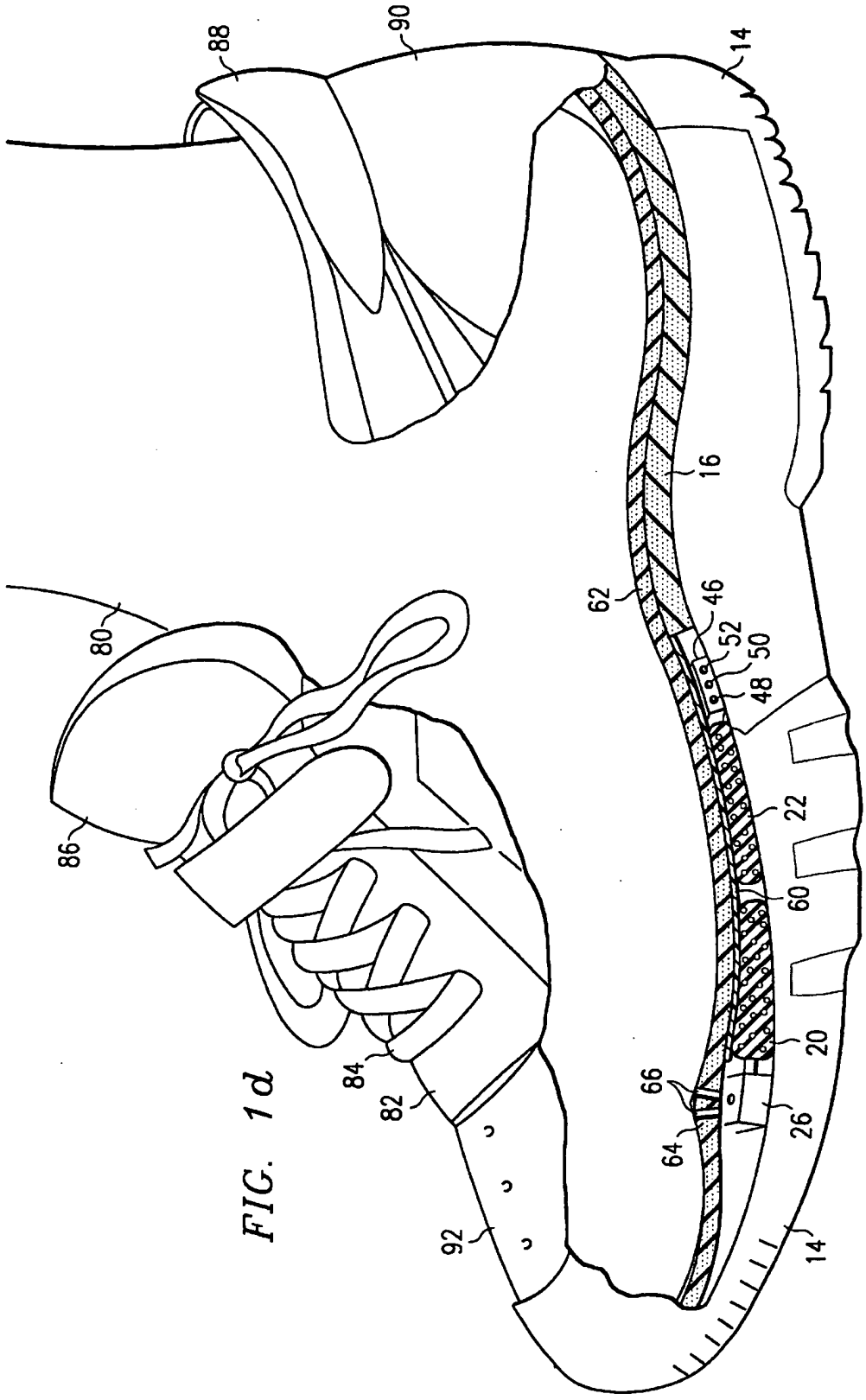

FIG. 1d

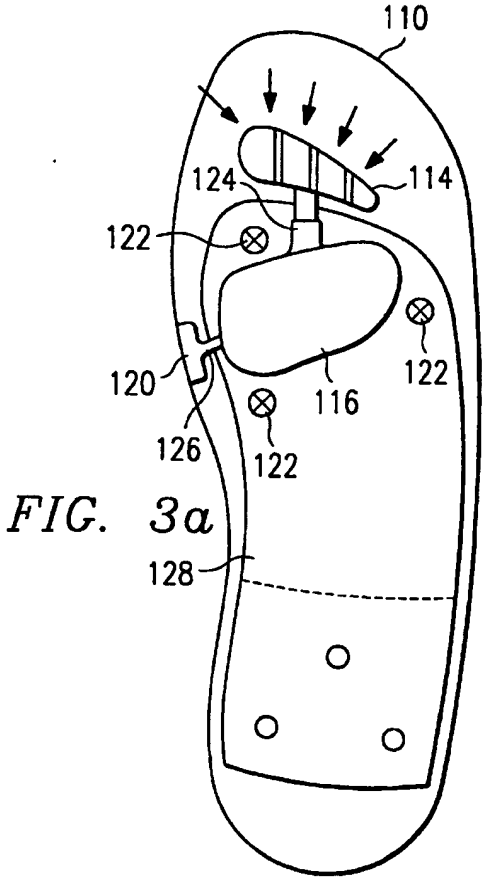

FIG. 3a

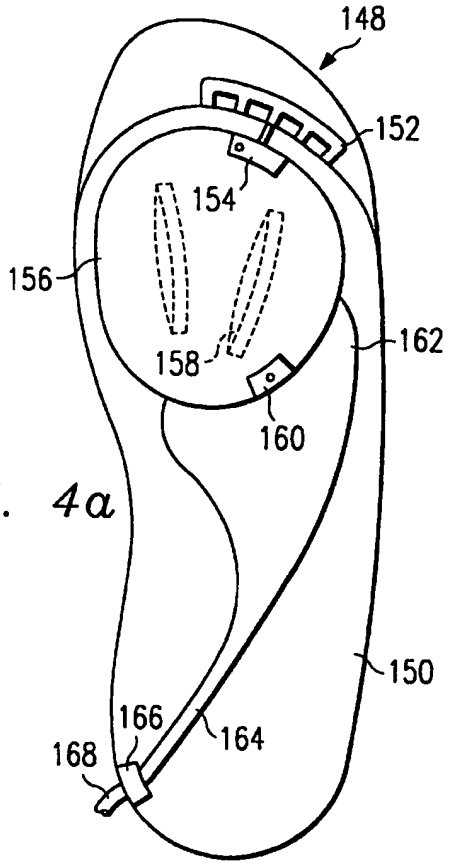

FIG. 4a

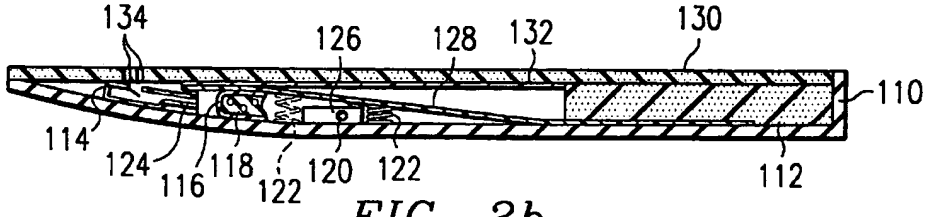

FIG. 3b

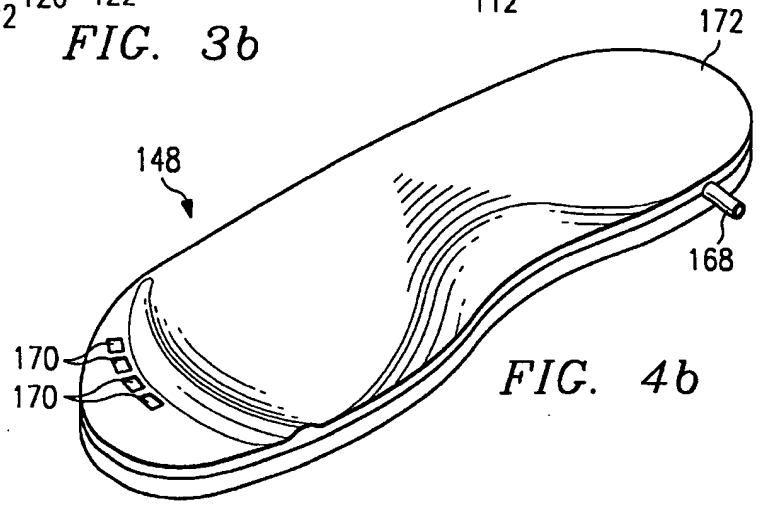

FIG. 4b

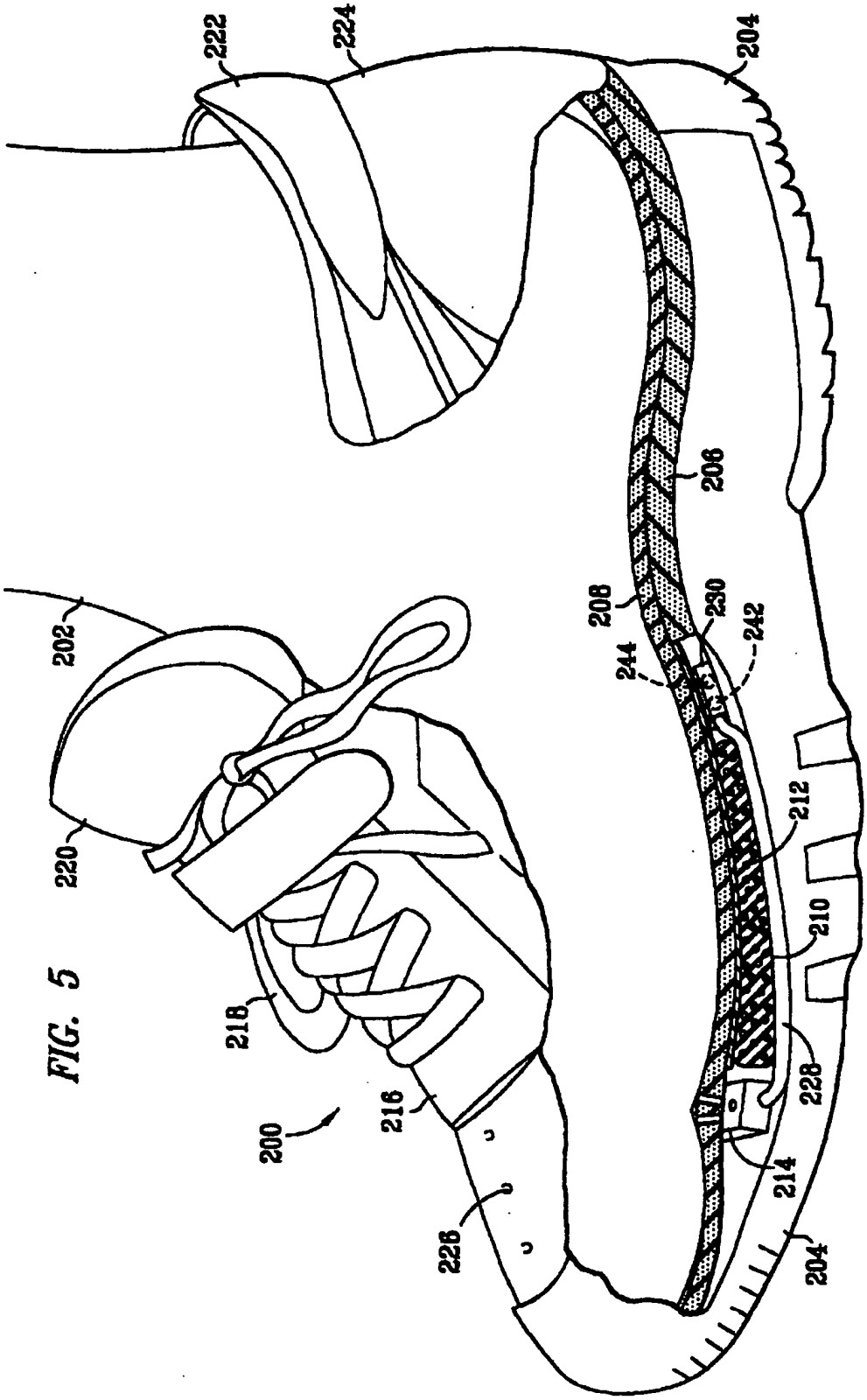
222
224
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FIG. 5

FIG. 6a

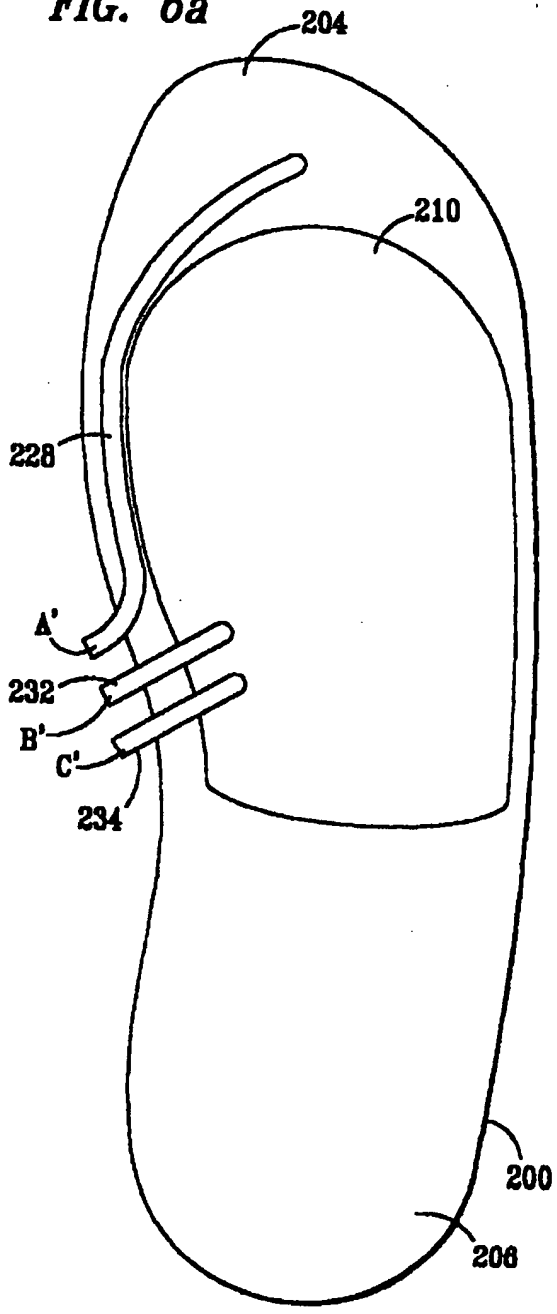


FIG. 6b

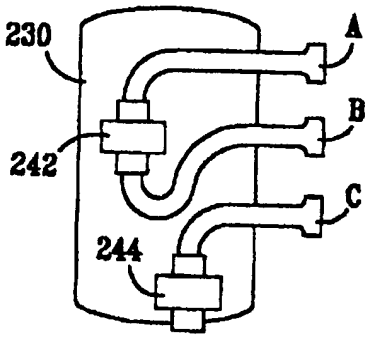


FIG. 7

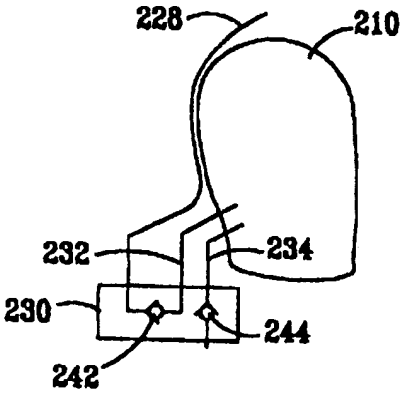


FIG. 8a

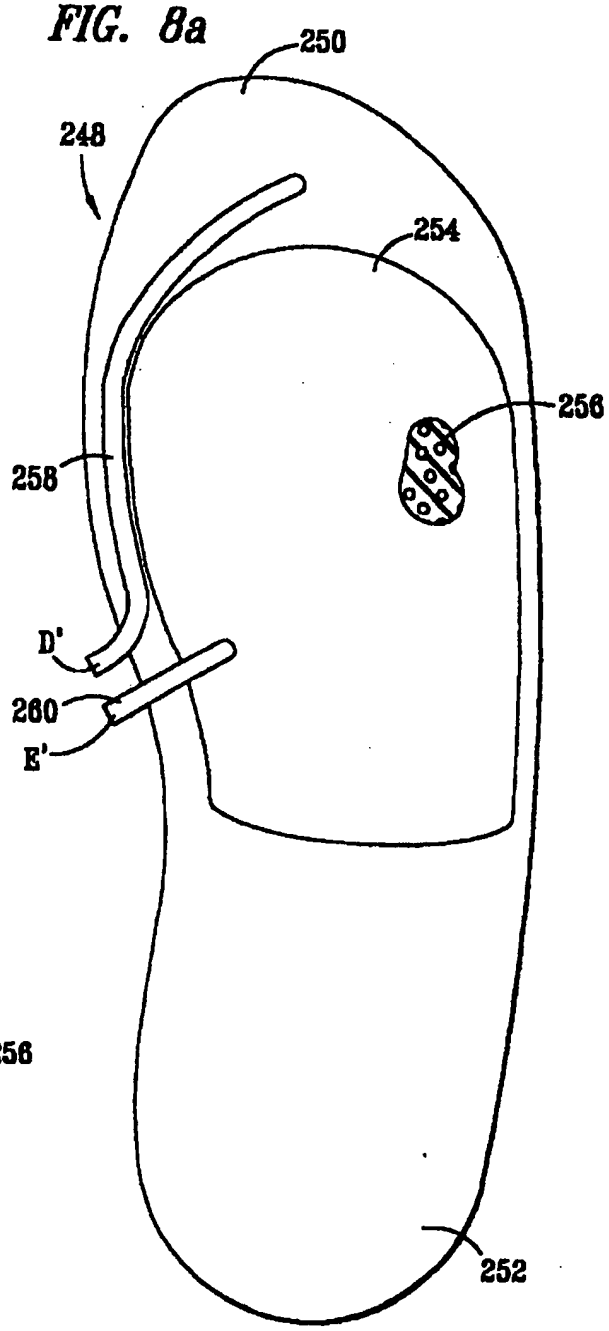


FIG. 8b

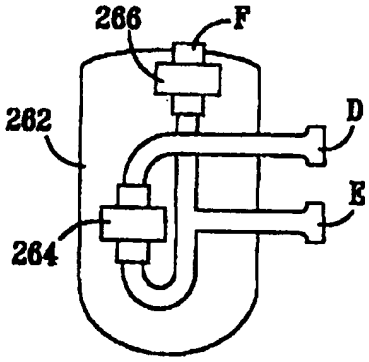


FIG. 9

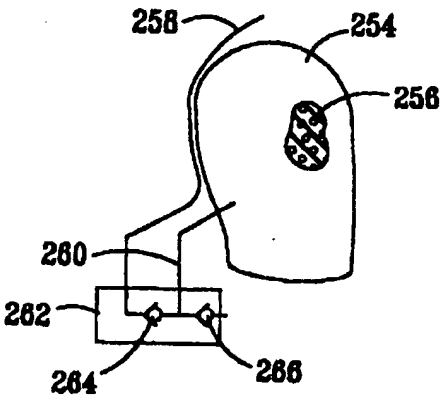


FIG. 10a

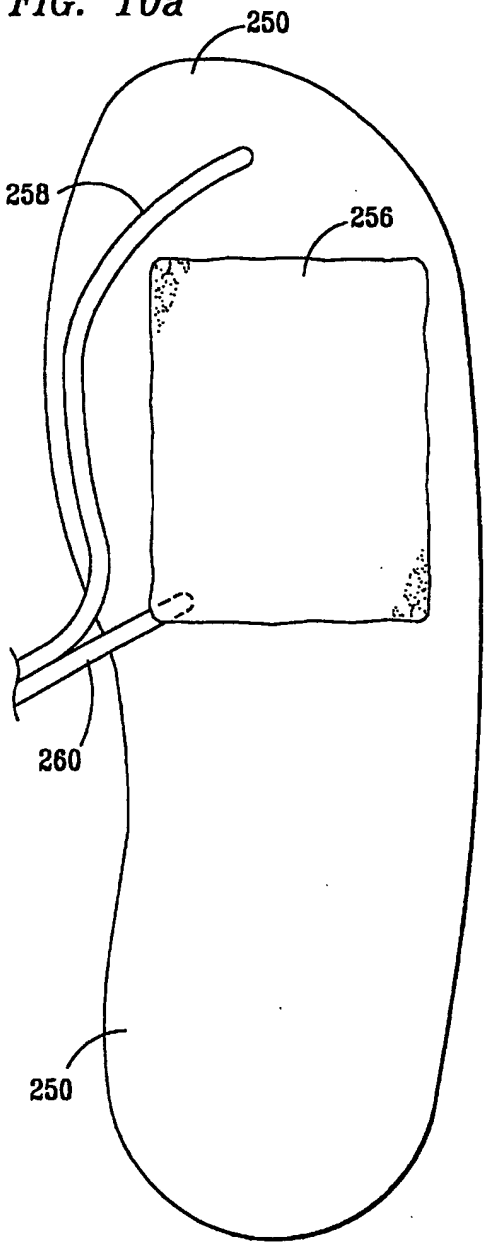


FIG. 10b

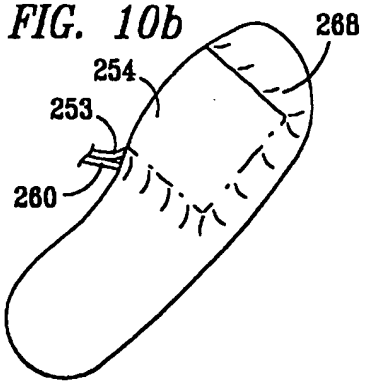


FIG. 10c

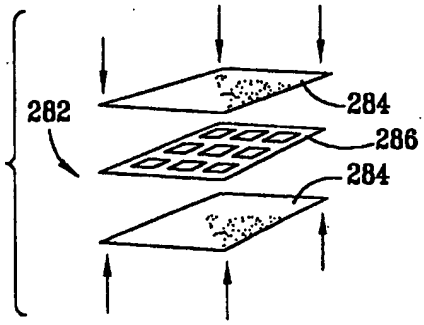


FIG. 10d

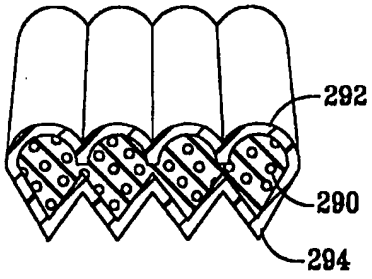


FIG. 10e

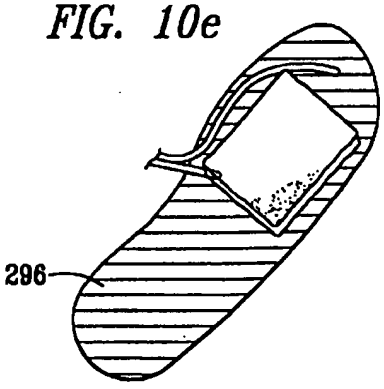


FIG. 11

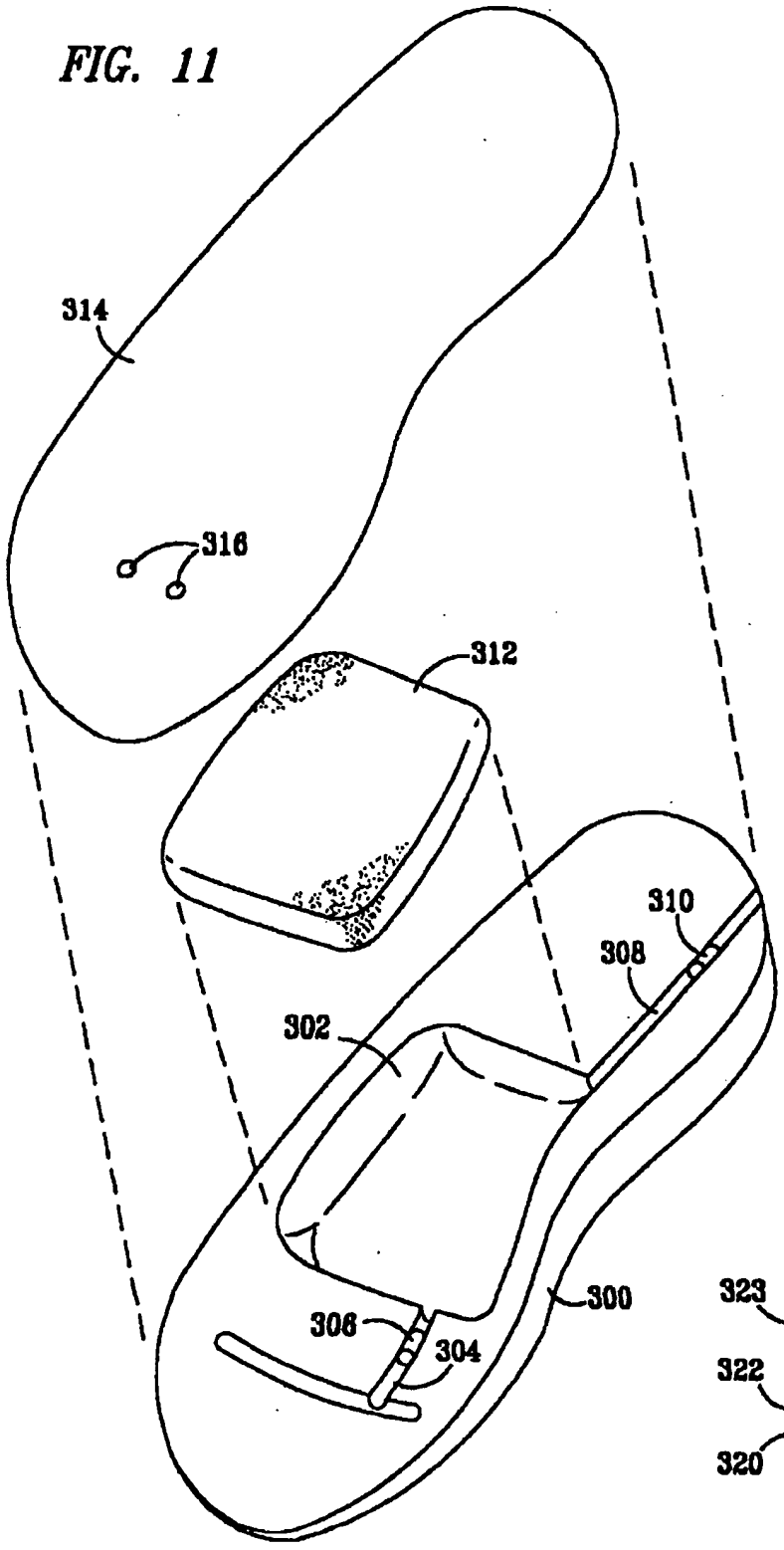


FIG. 12

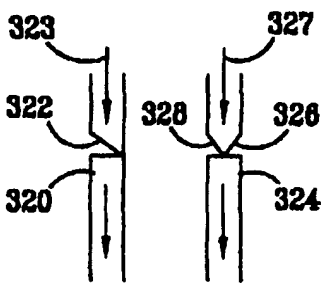
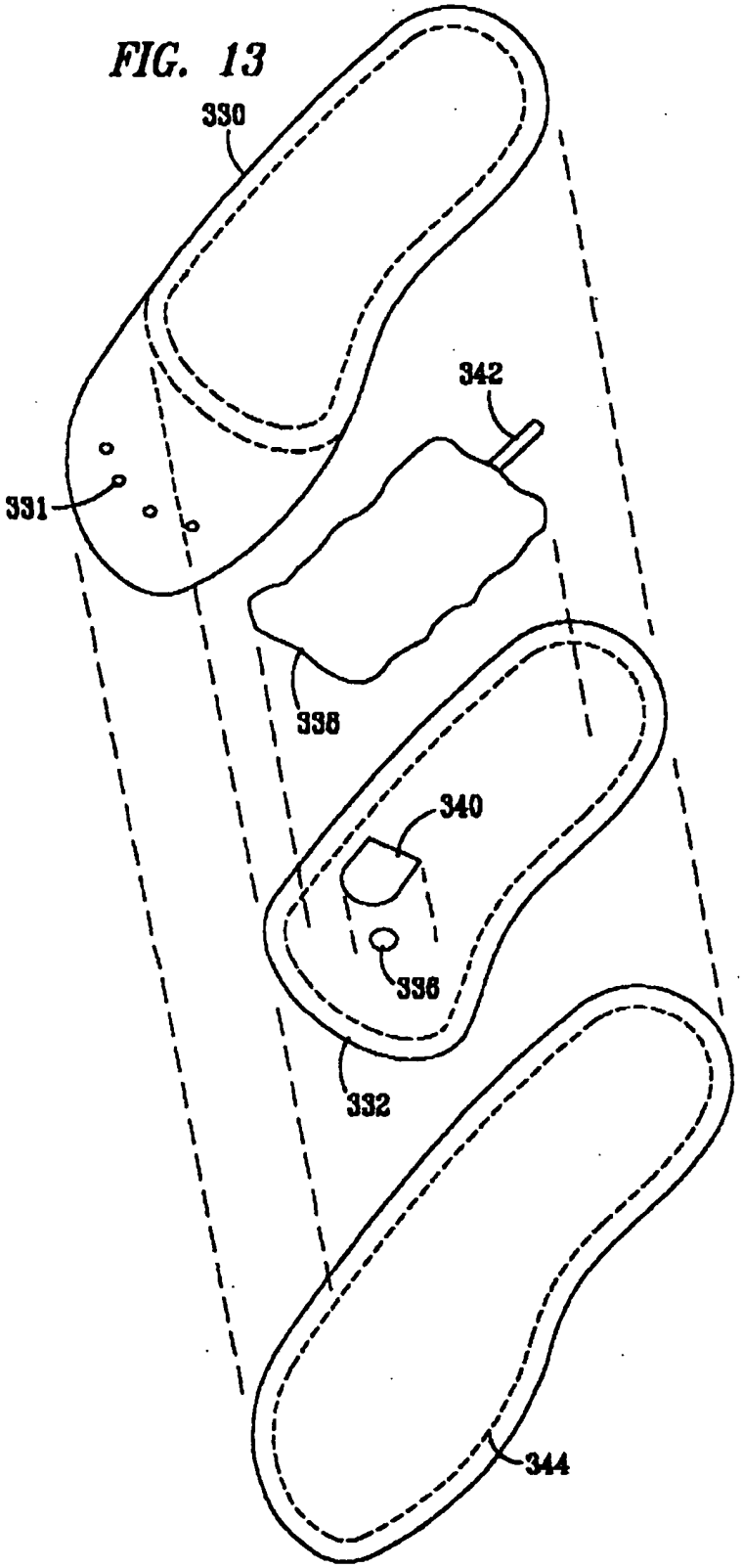


FIG. 13



AIR COOLED SHOE HAVING AN AIR EXHAUST PUMP

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation in part of U.S. patent application Ser. No. 08/325,678, filed Oct. 19, 1994 abandoned, and entitled "AIR COOLED SOLE", abandoned, and continued in U.S. patent application Ser. No. 08/648,861, filed May 6, 1996, and issued as U.S. Pat. No. 5,697,170 on Dec. 16, 1997.

TECHNICAL FIELD OF THE INVENTION

The present invention relates to a ventilated shoe and, more particularly, to a shoe having an air-pumping device to ventilate the shoe.

BACKGROUND OF THE INVENTION

Presently known ventilated shoes comprise elastomeric and resilient pads which are made of soft materials, such as sponge or rubber, and contain a plurality of holes in the sole and in the heel of the shoe in order to increase foot comfort. In these types of insoles, it is very difficult to remove moisture and the odor produced as a result of moisture which collects in the shoe due to foot sweating caused by poor shoe ventilation. Since most people use their shoes for long periods of time, it is essential to properly maintain and ventilate the shoes in order to avoid foot diseases, such as, for example, water-eczema.

According to a report of the American Podiatry Association, 75 percent of the males and females stand or walk for 4 hours a day. Such foot stress leads to foot problems, particularly in males, where athlete's foot fungi and the odor associated therewith have become a common problem.

SUMMARY OF THE INVENTION

The present invention disclosed and claimed herein comprises an air-cooled shoe operable to ventilate the interior of the shoe and the area around a human foot. An outer sole having a toe portion, a ball portion and a heel portion is provided. A shoe upper formed above the outer sole and attached to the outer sole is provided. A pump array is disposed above the ball portion of the outer sole. The pump array includes an air-tight pump cell which is defined by a flexible material and filled with an open cell material which causes the pump cell to expand and fill with air. The pump cell has an air intake disposed on the toe portion of the outer sole and an air exhaust connected to the outside ambient air. A semi-rigid layer is disposed over the entirety of the pump array. Two one-way valves are disposed in a detachable pod which allow air to enter the pump array in one direction and to exit the pump array in one direction.

In another aspect of the present invention, the pump cell has an intake/exhaust having a first and second end, with the first end connected to the pump cell and the second end connected to the one-way valve, allowing air to exit only through the exhaust and another one-way valve allowing air to enter only through the intake.

In a further aspect of the present invention, a first one-way valve is disposed along an air inlet and a second one-way valve is disposed along an exhaust. The first one-way valve allows air to enter the pump cell only through the inlet and the second one-way valve allows the air to exit only through the exhaust.

In yet a further aspect of the present invention, a shutoff valve may be disposed along the air intake for stopping air and liquid from passing through the air intake.

In yet a further aspect of the present invention, the air intake may be attached to a filtering device for filtering out large particles which are too large to be carried through the pump.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention and the advantages thereof, reference is now made to the following description taken in conjunction with the accompanying Drawings in which:

FIG. **1***a* illustrates a cutaway view of the system of the present invention;

FIG. **1***b* illustrates a top view of the system of the present invention;

FIG. **1***c* illustrates a side cross-sectional view of the system of the present invention;

FIG. **1***d* illustrates a side cutaway view of the system of the present invention;

FIG. **2***a* illustrates an exploded diagram of the construction of the pump cells;

FIG. **2***b* illustrates a cross-sectional view of an assembled pump cell;

FIG. **2***c* illustrates a perspective view of the pump cell;

FIG. **3***a* illustrates an alternative embodiment of the present invention;

FIG. **3***b* illustrates a cross-sectional view of an alternative embodiment of the present invention;

FIG. **4***a* illustrates a cutaway drawing of a shoe insert utilizing the system of the present invention.

FIG. **4***b* illustrates a perspective view of the shoe insert utilizing the system of the present invention;

FIG. **5** illustrates a side cutaway view of the ventilated shoe;

FIG. **6***a* illustrates a top view of the ventilated shoe with the upper and the inner sole removed;

FIG. **6***b* illustrates a cutaway view of the valve pod;

FIG. **7** illustrates a schematic diagram of the ventilated shoe and valve pad;

FIG. **8***a* illustrates a top cutaway view of an additional embodiment of a ventilated shoe with the shoe upper and inner sole removed;

FIG. **8***b* illustrates a cutaway view of a valve pod;

FIG. **9** illustrates a schematic diagram of the additional embodiment of the ventilated shoe and valve pad;

FIG. **10***a* illustrates a top view of a yet further embodiment of a ventilated shoe with the upper removed;

FIG. **10***b* illustrates a finished insole;

FIG. **10***c* illustrates a composite spring material which may replace the open cell foam;

FIG. **10***d* illustrates an alternate composite spring material;

FIG. **10***e* illustrates a top view of a molded insole and takes the portion thereof which is molded;

FIG. **11** illustrates a molded pump and hoses;

FIG. **12** illustrates two molded flat valves; and

FIG. **13** illustrates a membrane pump with integrated intake.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIG. **1***a*, there is illustrated a cutaway view of the system of the present invention. A sole **12** is

provided as part of an overall shoe (not shown). An outer sole **14** is provided and is roughly in the shape of a human foot (not shown), which fits over the top of the sole **12**. A heel pad **16** is disposed on the top of the outer sole **14** and covers the rear one-third area of the outer sole **14**. Toe impressions **18** are provided at the front edge of the outer sole **14**. The toe impressions **18** are slightly impressed areas of the outer sole **14** and are placed to coincide at the locations of the toes of a human foot (not shown), when placed over the sole **12**. A front pump cell **20** is provided and is placed on top of the outer sole **14**, such that it corresponds to the head of the metatarsus of the first shaft of the human foot and of the second shaft of the human foot, extending approximately halfway up the first and second shafts from the head towards the base. A right pump cell **22** is provided and placed above the outer sole **14**. The right pump cell **22** corresponds to the area between the head and the base of the metatarsus of the third, fourth, and fifth shaft. A rear pump cell **24** is provided and placed on top of the outer sole **14**. The location of the rear pump cell **24** corresponds to the location of the base of the metatarsus of the first and second shaft to midway between the base and the head of the metatarsus of the first and second shaft.

An intake manifold **26** is provided and located between the toe impressions **18** in the front of the front pump cell **20** and the right pump cell **22**. The intake manifold **26** is located such that it coincides the phalanges of the first through fifth shaft of the human foot. A front intake reed **28** is provided on the left side of the intake manifold **26** and is connected through a front intake tube **30** to the front pump cell **20**. A rear intake reed **40** is provided in the center of the intake manifold **26** and is connected by a rear intake tube **42** to the rear pump cell **24**. A right intake reed **34** is provided on the right side of the intake manifold **26** and is connected by the right intake tube **36** to the right pump cell **22**. The intake reeds **28, 40** and **34** allow air to flow only in one direction into the pump cells **20, 22** and **24**. An exhaust manifold **46** is provided and placed on the outer sole **14** of the sole **12**. The exhaust manifold **46** is located under the arch of the human foot. Located on the upper portion of the exhaust manifold **46** is a front exhaust reed **48**. The exhaust reed **48** is connected to the front pump cell **20** by a front exhaust tube **32**. Located in the center of the exhaust manifold **46** is a rear exhaust reed **50**. The rear exhaust reed **50** is connected to the rear pump cell **24** by a rear exhaust tube **44**. Located on the lower portion of the exhaust manifold **46** is a right exhaust reed **52**. The right exhaust reed **52** is connected to the right pump cell **22** by a right exhaust tube **38**. The exhaust reeds **46, 50** and **52** allow air to pass through them in only one direction, that is, from the exhaust tubes **32, 44** and **38**. The exhaust manifold **46** has one outlet into the outside air which is connected to a tube **54** to pass through the outer sole **14** of the sole **12**.

Referring now to FIG. **1***b*, there is illustrated a top view of the sole **12**. The top layer of the sole **12** is a pad **62** running the full length of the sole **12** covering the outer sole **14**. This pad **62** is the same shape as the outer sole **14**. A semirigid layer **60** is located just beneath the pad **62** in an area covering the pump cells (not shown). A raised area **64** is located on the top of the pad **62** and coincides with an area just under the base of the phalanges of the first through the fifth shaft of the toes of the human foot. Disposed in the raised area **64** are intake holes **66**. These holes **66** perforate the pad **62** to allow air to pass from the air around the foot through the intake holes **66** to the intake manifold **26** (not shown) located just beneath the intake holes **66**. The semi-rigid layer **60** is used to support the foot while allowing the foot to press down against the pump cells (not shown). The heel pad **16** is shown underneath the pad **62**.

Referring now to FIG. **1***c*, there is illustrated a sectional view of the system of the present invention. The outer sole **14** is shown extending from the rear of the shoe across the bottom of the rear of the sole **12** running the full length of the sole **12**. The heel pad **16** is shown passing from the rear of the outer sole **14** one-third of the length of the outer sole **14**. The exhaust manifold **46** is shown containing the front exhaust reed **48**, the rear exhaust reed **50**, and the right exhaust reed **52**. The rear pump cell **24** is shown, as is the front pump cell **20**. The intake manifold **26** is shown. Placed above the front air cell **20** and the rear air cell **24**, the semirigid layer **60** runs from the front pump cell **20** to the rear of the exhaust manifold **46**. Covering the full length of the sole 12 from the rear of the heel pad **16** to the front of the outer sole **14** is the pad **62**. The toe impressions **18** are shown disposed in the pad **62**. The raised area **64** is shown just behind the toe impressions **18**. The intake holes **66** are shown perforating the pad **62** and disposed in the area of the raised area **64**. The intake holes **66** are also disposed just above intake manifold **26**. Also shown is the open-celled foam **70** located inside the front pump cell **20** and the rear pump cell **24**.

Referring now to FIG. **1***d* there is illustrated a side cutaway view of the system of the present invention. The outer sole **14** is shown running from the front of the human foot to the rear of the human foot **80**. A typical tennis shoe upper **82** is shown connected to the outer sole **14**. The tennis shoe upper contains laces **84**, a tongue **86**, a collar **88**, and a body **90**. The shoe has vents **92** placed in the toe area. The pad **62** is shown running from the heel of the foot **80** to the toes of the foot **80**. The raised area **64** is shown positioned under the base phalanges of the foot **80**. Intake holes **66** are shown disposed in the pad **62** at the raised area **64**. The intake manifold **26** is shown disposed directly beneath the intake holes **66**. The front pump cell **20** is shown disposed directly in front of the rear pump cell **22**. The exhaust manifold **46** is shown having the front exhaust reed **48**, the rear exhaust reed **50**, and the right exhaust reed **52** disposed therein. The heel pad **16** is shown disposed between the foot **80** and the outer sole **14**. The semirigid layer **60** is shown disposed between the pad **62** and the front pump cell **20** and the rear pump cell **24**.

In operation, the human foot (not shown) fits over the sole **12**. The human foot is outlined by the outer sole **14**. The heel of the human foot fits over the heel pad **16** with the five toes of the human foot each fitting into a corresponding one of the toe impressions **18**. The front intake reed **28**, the rear intake reed **40**, and the right intake reed **34** allow air to pass in only one direction from the interior of the shoe into the tubes **30, 42**, and **36**. The front exhaust **48**, the rear exhaust reed **50**, and the right exhaust reed **52** also allow, air to pass in only one direction that being from the exhaust tubes **32, 38**, and **44** through the outside exhaust tube **50**. Therefore, when the pressure of the foot (not shown) is not pressing on the front pump cell **20**, the right pump cell **22**, and the rear pump cell **24**, the open-celled foam **70** inside the pump cells **20, 22**, and **24** causes the pump cells **20, 22**, and **24** to expand, thereby drawing air through the intake manifold **26** and through the intake reeds **28, 40**, and **34**, through the intake tubes **30, 42**, and **36**, and into the pump cells **20, 22**, and **24**. This draws air from the interior of the shoe and around the foot into the front pump cell **20**, the rear pump cell **24**, and the right pump cell **22**.

When a person steps with his foot onto a surface, the foot then presses down on the pad **62**, the front pump cell **20**, the

right pump cell **22**, and the rear pump cell **24**. This compresses the pump cells **20**, **22** and **24** and compresses the open-celled foam **70** inside the pump cells **20**, **22** and **24**. This, in turn, causes the air from the front pump cell **20** to be expelled through the front exhaust tube **32**, through the exhaust reed **48**, and thereby through the outside exhaust tube **54**. This also causes air from the right pump cell **22** to be expelled through the right exhaust tube **38**, through the right exhaust reed **52**, and through the outside exhaust tube **54**. Finally, this causes air inside the rear pump cell **24** to be expelled through the tube **44**, through the rear exhaust reed **50**, and through the outside exhaust tube **54** into the outside ambient air. This happens with each step.

After a person lifts his foot off the ground to take another step, the air is drawn through the intake reeds **28**, **40** and **34**, through the intake tubes **30**, **36** and **42**, and into the pump cells **20**, **22** and **24**. Air is only drawn through the intake reeds **28**, **30** and **44**, and not through the exhaust reeds **48**, **50** and **52**, because air can only be expelled out of the exhaust reeds **48**, **50** and **52** in the direction of the outside exhaust tube **54** from the pump cells **20**, **22** and **24**. Once the pump cells **20**, **22** and **24** are filled with air when a person steps onto a surface, the foot presses down on the pump cells **20**, **22** and **24**, pressing them against the outer sole **14** of the sole **12**, causing the pump cells **20**, **22** and **24** to be compressed and the air to be expelled through the tubes **32**, **42** and **38**, through the exhaust reeds **48**, **50** and **52**, and through the outside exhaust tube **54** into the outside ambient air.

This system, comprising multiple pump cells **20**, **22** and **24**, and multiple intake reeds **28**, **34** and **40**, provides consistent air transfer during changing foot positions and walking due to the multiple pump cells **22**, **24** and **20** and the semirigid layer **60** placed over the pump cells **20**, **22** and **24**. Since the pump cells **20**, **22** and **24** each have individual intake reeds **28**, **40** and **34**, individual intake tubes **30**, **42** and **36**, individual exhaust tubes **32**, **44** and **38**, and individual exhaust reeds **48**, **50** and **52**, this allows the individual pump cells **20**, **22** and **24** to operate independently from each other. This also causes increased service life due to the fact that the failure of the exhaust reeds **46**, **50** and **52** is the most probable cause of system malfunction. Since each pump cell **20**, **22** and **24** has its own exhaust reed **46**, **50** and **52**, the rate of reduction is fractional, since it is unlikely that all of the exhaust reeds **46**, **50** and **52** will fail simultaneously.

Referring now to FIG. **2***a*, there is illustrated an exploded diagram of the construction of a pump cell **98**. The pump cell **98** consists of a plastic tube inlet **104**, a plastic tube outlet **106**, a main tubing **100**, and an open-celled foam filler **102**. Referring now to FIG. **2***b*, there is illustrated a longitudinal section view of an assembled pump cell **98**. The plastic tube inlet **104** is shown inserted to the open-celled foam filler **102**, which is inserted into the main tubing **100**. The plastic tube outlet **106** is shown also inserted into the open-celled foam filler **102**. Referring now to FIG. **2***c*, there is illustrated a perspective view of the pump cell **98**. The open-celled foam filler **102** is shown inside the main tubing **100**, with the plastic tube inlet **104** inserted through the main tubing **100** into the open-celled foam filler **102**. The plastic tube outlet **106** is shown inserted into the open-celled foam filler **102** and through the main tubing **100**.

In operation, the open-celled foam filler **102** is normally in an expanded position as shown in FIG. **2***b*, such that it holds the two sides of the main tubing **100** apart from each other. This in turn traps air in the open-celled foam filler **102**. Air comes in through plastic tube inlet **104**. The air may only flow inward through plastic tube inlet **104** and may only flow out through plastic tube outlet **106**. When the main tubing **100** is compressed by a human foot (not shown), the open-celled foam filler **102** is compressed together and the two sides of the main tubing **100** move towards each other. This in turn causes the air inside the open-celled foam filler **102** to be expelled through the plastic tube outlet **106**.

Referring now to FIGS. **3***a* and **3***b*, there is illustrated an alternative embodiment of the present invention. An outer sole **110** is shown approximately in the shape of an outline of a human foot. A heel pad **112** is shown covering the rear one-third of the outer sole **110**. An intake grille **114** is provided. A pump bladder **116** is provided and is filled with an open-celled foam **118**. The pump bladder **116** is connected to the intake grille **114** through an inlet reed **124**. An exhaust port **120** is provided and is connected to the pump bladder **116** through an outlet reed **126**. A pump lever **128** is provided and runs from below the heel pad **112** up to the intake grille **114**. Pump return springs **122** are provided and positioned between the outer sole **110** and the pump lever **128**. The pump lever **128** is positioned such that it is directly above the pump bladder **116**. A semirigid layer **132** (not shown in FIG. **3***a*) is then positioned above pump lever **128**, and a pad **130** (not shown in FIG. **3***a*) is positioned above the heel pad **112**. The semirigid layer **132** runs the full length of the outer sole **110** from the front of the outer sole **110** to the rear of the outer sole **110**. Intake holes **134** are disposed in the pad **130** running through the full height of the pad **130**.

In operation, when a human foot is not pressing upon the pad **130**, this allows the open-celled foam **118** inside the pump bladder **116** to expand, drawing air from around the toes of a human foot, through the intake holes **134**, through the intake grille **114**, through the inlet reed valve **124**, and into the pump bladder **116**. When the human foot is pressed down on the pad **130**, it pushes the semirigid layer **132** down upon the pump lever **128**, which compresses the open-celled foam **118** in the pump bladder **116** and expels the air in the pump bladder **116** through the outlet reed **126**, and then through the exhaust port **120**. When pressure is released from the pump lever **128**, the pump lever is raised by the pump return springs **122**, such that the open-celled foam **118** in the pump bladder **116** may expand to draw in air.

Referring now to FIG. **4***a*, there is illustrated a cutaway drawing of a shoe insert **148** utilizing the system of the present invention. The shoe insert **148** consists of a base **150**. The insert **148** also consists of an intake manifold **152**. The intake manifold **152** is connected to a main pump cell **156** through an intake reed **154** which allows air to travel only from the direction of the intake manifold **152** to the main pump cell **156**. The main pump cell **156** has semirigid walls and is expanded by leaf springs **158** disposed on the interior of the main pump cell **156**. The main pump cell **156** is connected to a secondary pump cell **162** through a first exhaust reed **160**, which allows air to flow only in the direction from the main pump cell **156** to the secondary pump cell **162**. An exhaust tube **164** is connected to the secondary pump cell **162**. The exhaust tube **164** has disposed near its end a second exhaust reed **166** allowing air to flow only from the secondary exhaust bladder **156** and not into the secondary exhaust bladder **156**. A tube **168** is connected to the outward side of the second exhaust reed **166**.

Referring now to FIG. **4***b*, there is illustrated a perspective view of the complete insert **148**. A pad **172** is disposed over the full length of the base **150**. Disposed in the pad **172** near the front of the pad **172** are intake holes **170**. The intake holes **170** allow air from around the toes of the foot to travel through the pad **172** to the intake manifold **152**.

In operation, the insert **148** can be disposed inside a normal athletic shoe between the foot of the wearer and the

sole of the shoe. Once the insert **148** is inserted into a normal athletic shoe between the foot of the wearer (not shown) and the sole of the athletic shoe, the secondary pump cell **162**, and the main pump cell **156** are filled with air. When a person first steps down with their heel, their foot presses the air out of the secondary pump cell **162**, through the exhaust tube **164**, out the second exhaust tube **166**, and out the outlet tube **168**. When a person rolls onto the ball of their foot, air is expelled from the main pump cell **156**, through the exhaust reed **160**, and into the secondary exhaust cell **162**. When a person then completes his step and lifts his foot off of the ground, the leaf springs **158** in the main pump cell **156** expand the main pump cell **156**, drawing air through the intake holes **170** from around the toes of the human foot (not shown), into the intake manifold **152**, through the intake reed **154**, and into the main pump cell **156**. Then the cycle starts over again with the person expelling the air from the secondary pump cell **162**, and then expelling the air from the cell **156** into the secondary exhaust cell **162** as stated above.

Referring now to FIG. **5**, there is illustrated a side cutaway view of the system of the present invention. A ventilated shoe **200** is shown. A human foot **202** is provided and is disposed inside the ventilated shoe **200**. An outer sole **204** is provided. A typical tennis shoe upper **216** is shown connected to the outer sole **204**. The tennis shoe upper contains laces **218**, a tongue **220**, a collar **222** and a body **224**. The ventilated shoe **200** has vents **226** disposed in the toe area. A pump cell **210** is disposed between the human foot **202** and the outer sole **204**. Disposed inside the pump cell **210** is open-cell foam **212**. The pump cell **210** is disposed in the inner sole **208**. Also disposed in the inner sole **208**, near the toe portion of the human foot **202**, is a filter **214**. Connected to the filter **214** is an intake tube **228**. The intake tube **228** runs from the filter **214** along the pump cell **210** to the midsection of the human foot **202**. A valve pod **230** is disposed near the midsection of the outer sole **204**. The valve pod **230** contains two one-way valves, one valve being an intake valve **242** and the other valve being an exhaust valve **244** (shown in FIG. **6***b*). The intake tube **228** is connected to the inlet of the intake valve **242**. The outlet of the intake valve **242** is connected to the pump cell **210**. The inlet of the exhaust valve **244** is connected to the pump cell **210** and the outlet thereof is connected through an opening **232** to the outside ambient air. A heel pad **206** is disposed in the inner sole **208** between the valve pod **230** and the rear of the shoe **200**.

Referring now to FIG. **6***a*, there is illustrated a top view of the ventilated shoe **200** with the upper **216** and the inner sole **208** removed. The outer sole **204** is shown having the shape of an outline of the human foot **202** (shown in FIG. **5**). The heel pad **206** is disposed on top of the outer sole **204** and covers the rear one-third area of the outer sole **204**. The pump cell **210** is shown disposed on the outer sole **204**. Intake tube **228** is shown extending from the toe portion of the outer sole **204** to exit the outer sole **204** at the midsection. The pump intake tube **232** is shown with one end connected inside the pump cell **210** and the other end extending outward from the outer sole **204** near the area where the intake tube **228** extends from the outer sole **204**. An exhaust tube **234** is disposed such that it extends from inside the pump cell **210** to the outside of outer sole **204** in the approximate area of the pump intake tube **232**. Proximate to the area where the intake tube **228**, the pump intake tube **232**, and the exhaust tube **234** exit, the outer sole **204** may be recessed such that the area is indented into the outer sole **204**.

Referring now to FIG. **6***b*, there is illustrated a cutaway view of the valve pod **230**. The valve pod **230** contains an intake valve **242** and an exhaust valve **244**. The intake valve **242** and the exhaust valve **244** allow air and liquid to pass in only one direction from the inlet to the outlet. The inlet A of the intake valve **242** is connected to the outlet A of the intake **228**. The outlet B of the intake valve **242** is connected to the open end B of pump intake tube **232**. The inlet C of the exhaust valve **244** is connected to the second end C of the exhaust tube **244** and the outlet of the exhaust valve **244** is connected to the outside ambient air. The valve pod **230** is thus located on the outside of the outer sole **204** of the ventilated shoe **200**. This allows for easy cleaning and replacement of the valve pod **230**. The pump cell **210** may be bonded together by adhesives exclusively, or may be bonded by heat means. The outlet side of the exhaust valve **244** may be fitted with a charcoal filter or condenser, as needed. The pump intake tube **232** may be located at the left rear of the pump cell **210**, as shown in FIG. **6***a*, or it may be located at the extreme rear of pump cell **210**, or at the front of pump cell **210**. It does not matter where the pump intake tube **232** or the exhaust tube **234** connects to pump cell **210**.

Referring now to FIG. **7**, there is illustrated a schematic diagram of the apparatus shown in FIGS. **6***a* and **6***b*. The pump cell **210** is shown having the pump intake tube **232** connected thereto and the exhaust tube **234** also connected thereto. The intake tube **228** is shown connected to the inlet of intake valve **242**. The outlet of intake valve **242** is connected to the pump intake tube **232** whose opposite side is connected to the pump cell **210**. The opposite side of exhaust tube **234** is connected to the inlet of exhaust valve **244**. The outlet of exhaust valve **244** is connected to the outside ambient air.

In operation, the human foot **202** fits over the outer sole **204** and into the upper **216** of the ventilated shoe **200**. The heel of the human foot **202** fits over the heel pad **206**. The toes of the human foot fit into the front of the ventilated shoe **200** with the arch between the toes and the foot fitting just over the filter **214**. Air is allowed to pass through the filter **214**, through the intake tube **228**, through the intake valve **242**, and through the pump intake tube **232** and to the pump cell **210**. This is allowed to happen when the human foot **202** is not exerting pressure on the pump cell **210** and the open-cell foam **212** in the pump cell **210** expands the pump cell **210**. This draws air from the interior of the shoe **200** into the pump cell **210**. The intake valve **242** only allows air to pass from the intake tube **228** into the pump intake tube **232** in that particular direction. Air is not allowed to pass from the pump cell **210** through the pump intake tube **232** into the intake tube **228**. Moisture and liquid, along with air, may be drawn through the filter **214** and into the pump cell **210**. Air is then drawn into the shoe **200** through the vents **226** and around the collar **222** to replace the air that is drawn through the filter **214** into the pump cell **210**.

When pressure is exerted from the human foot **202** onto the outer sole **204**, the pump cell **210** is compressed by the pressure. This in turn compresses the open-cell foam **212** which is inside the pump cell **210**. This causes the air or water vapor from the pump cell **210** to be expelled through the exhaust tube **234** and pass through the one-way exhaust valve **244** into the outside ambient air. The exhaust valve **244** does not allow air or liquid from the outside to pass through the exhaust valve **244** into the exhaust tube **234**, thereby entering the pump cell **210**. When the human foot **202** is then lifted off the ground, the air is once again drawn through the filter **214** through the intake tube **228**, through the intake valve **242**, and through the pump cell **244** and into the pump cell **210**. A cut-off valve (not shown) may be added between the filter **214** and the intake valve **242** along the

intake tube **228**. If the cut-off valve is activated, the air will no longer be drawn from the area around the human foot **202**.

Referring now to FIG. **8***a*, there is illustrated a top cutaway view of an additional embodiment of a ventilated shoe **248** with the shoe upper and inner sole removed. An outer sole **250** is provided having a shape of an outline of the human foot **202**. A heel pad **252** is disposed on top of the outer sole **250** and covers a rear one-third area of the outer sole **250**. A pump cell **254** is shown disposed on the outer sole **250** covering an area from approximately the toe area of the outer sole **250**, along two-thirds of the outer sole **250**, and also covering nearly the fall width of the outer sole **250**. An intake tube **258** is disposed to extend from the toe portion of the outer sole **250** and has an outlet D to the midsection of outer sole **250**. A monotube **260** is disposed running from the interior of the pump cell **254** through the outer sole **250** to exit the outer sole **250** at port E, adjacent to the intake tube **258**. The monotube **260** may be located at the rear, sides, or front of the pump cell **254**. Also, the pump cell **254** may be confined to just the toe section of the outer sole **250**, or may run throughout the entire surface area of the outer sole **250**. Both the intake tube **258** and the monotube **260** may be merely passages between the pump cell **254** and either the interior of the shoe with respect to intake tube **258** and the exterior of the shoe with respect to monotube **260**. The intake tube **258** and the monotube **260** exit the outer sole **250** and are recessed such that the area is indented in the side of the outer sole **250**. An open-cell foam **256** or other expandable material may be used to fill the pump cell **254**, such that when pressure is released from on top of the pump cell **254**, the open-cell foam **256** will expand the pump cell **254**.

Referring now to FIG. **8***b*, there is illustrated a cutaway view of a valve pod **262**. An intake valve **264** is disposed in valve pod **262**. Intake valve **264** has an inlet D and an outlet E. The inlet D of the valve **264** is connected to the outlet D of intake tube **258**. The outlet E of the intake valve **264** is connected to the monotube **260**. An exhaust valve **266** is also provided and disposed in the valve pod **262**. The exhaust valve **266** has an inlet E and an outlet F. The outlet F of the exhaust valve **266** is open to the outside air through the side valve pod **262**. The inlet E of exhaust valve **266** is connected to monotube **260**, and is also the same port as the outlet E of the intake valve **264**. The valve pod **262** fits in the recessed area of outer sole **250** and connects to intake tube **258** and monotube **260**. The intake valve **264** allows air to pass in a one-way direction from intake tube **258**, through monotube **260** and into pump cell **254**. The exhaust valve **266** allows air to pass in a one-way direction from pump **254**, through monotube **260**, and through the exhaust valve **266**.

Referring now to FIG. **9**, there is illustrated a schematic diagram of the apparatus shown in FIGS. **8***a* and **8***b*. The pump cell **254** is shown having a monotube **260** connected thereto. The intake tube **258** is shown connected to the inlet D of the intake valve **264** of the valve pod **262**. The outlet E of intake valve **264** is connected to the monotube **260**. The inlet E of the exhaust valve **266** of the valve pod **262** is also connected to the monotube **260** with the outlet F of exhaust valve **266** connected to the outside ambient air. The opposite end of monotube **260** is connected to pump cell **254**.

In operation, the human foot fits over the outer sole **250** and into the upper of the ventilated shoe **248**. The heel of the human foot **202** fits over the heel pad **252**. The toes of the human foot **202** fit into the front of the ventilated shoe **248**, over the front of the outer sole **250** with the arch between the toes and the foot fitting just over a filter (not shown), which is positioned just over the inlet of inlet tube **258**. When pressure is released from the pump cell **254** and the open-cell foam **256** inside the pump cell **254** causes the pump cell **254** to expand, air is drawn through the filter and into the inlet of intake tube **258**. The air and/or liquid then passes through intake valve **264** and through the monotube **260** into the pump cell **254**. Once the open-cell foam **256** is fully expanded and the pump cell **254** is full of air, pressure on the pump cell **254** from the human foot compresses the open-cell foam **256**, which is inside the pump cell **254**. This, in turn, causes any air or liquid inside the pump cell **254** to pass through the monotube **260** and through the exhaust valve **266** to the outside ambient air. Air and/or water is not allowed to pass from the outside ambient air through the exhaust valve **266** and into the pump cell, nor is air or liquid allowed to pass from the pump cell **254**, through the intake valve **264**, into the intake tube **258**, and thereby into the interior of the shoe **248**. A cutoff valve (not shown) may be added between the inlet of the intake tube **258** and the intake valve **264** along the intake tube **228**. If the cutoff valve is activated, air will no longer be drawn from the area around the human foot.

The exhaust pressure from the exhaust valve **266** may be used to operate connectivity energy devices, such as a pressured drink bottle or inflatable suspension support devices. Also, the rate at which air or water may be exhausted from the exhaust valve **266** may be regulated, such that a pressure cushion is kept in the pump cell **254** and air is only exhausted when the pressure rises above a given air pressure. This regulated release of the exhaust by restriction of the exhaust opening provides a collapsing cushion with a rate determined by the size of the exhaust passage.

Referring now to FIG. **10***a*, there is illustrated a top view of a ventilated shoe with the upper removed. In a first step of the production technique to manufacture a sole **250** of the ventilated shoe described above with respect to FIGS. **8***a*, **8***b*, and **9**, the open-cell foam **256**, the intake tube **258**, and the monotube **260** are placed in an injection mold for the sole **250**. These elements are placed over the sole **250** and in the area to be injection molded to form the insole of the shoe. At this point, closed cell, airtight material (not shown) is forced into the confines of the mold encapsulating the pump foam.

Referring now to FIG. **10***b*, there is illustrated the finished insole. The closed cell material **26** forms airtight boundaries around the pump cell **254**. This also cushions the area above the outer sole **250**, as well as enclosing and forming the airtight pump cell **254**. The inner sole material **268** also holds the intake tube **258** and the monotube **260** in place. In this process, the open-cell foam **256** defines the pump perimeter before the closed-cell foam **270** is injected into the molding cavity.

Referring now to FIG. **10***c*, there is illustrated a composite spring material **282** which may replace the open-cell foam **256**. The composite spring consists of multilayers **282** using multiple materials. Two open-cell wafers **284** are placed surrounding a closed-cell foam wafer **286**. The two open-cell wafers **284** are attached to the closed-cell wafer **286**. The closed-cell wafer **286** may be "waffled" or have other shapes to help absorb shock and to return to its original shape.

Referring now to FIG. **10***d*, there is illustrated an alternate composite spring material **288**. An open-cell foam **290** is deposited between two layers of rubber or vinyl extrusion **292** and **294**. The layers **292** and **294** may be formed with a semicircular shape as in the extrusion **292** or in a triangular

shape as in the extrusion **294**. The space in between **292** and **294** is filled with the open-cell foam **290**.

Referring now to FIG. **10***e*, the area of the injection mold **296** is depicted by hatching.

Referring now to FIG. **11**, there is illustrated a molded pump and channels. A midsole **300** is provided. A depression **302** is molded in the midsole. The depression is about one-half the depth of the midsole and runs nearly from side-to-side of the midsole **300**. An intake channel **304** is also molded into midsole **300**. The intake channel is "T" shaped with the top of the "T" running side-to-side across the toe portion of midsole **300** and the vertical part of the "T" runs into the depression **302**. An exhaust channel **308** is also molded into midsole **300**. The exhaust channel **308** runs from the rear of the depression **302** to the end of the midsole **300**. The depression **302**, the intake channel **304**, and the exhaust channel **308** are all molded at the time the midsole **300** is molded. Open-cell foam **312** is placed in the molded depression **302** such that half of the open-cell foam **312** rises above the plane of the midsole **300**. An airtight flexible membrane **314** is provided having toe channel perforations **316**. These toe channel perforations **316** correspond to and are positioned directly over the top of the "T" of intake channel **304**.

An intake valve **306** is pressed into intake channel **304**. The intake valve **306** allows air to pass from the intake channel **304** into the depression **302**. An exhaust valve **310** is pressed into the exhaust channel **308**. The exhaust valve **310** allows air to pass from the depression **302** through the exhaust channel **308** and out the rear of the midsole **300**. The membrane **314** is bonded over the midsole **300**, intake valve **306**, exhaust valve **310**, exhaust channel **308**, intake channel **304**, and molded depression **302**. The membrane **314** is sealed in an airtight manner to the flat portions of the midsole **300** which were not molded into the channels **308** or **304** or the depression **302**.

When pressure is released from the membrane **314**, the open-cell foam **312** expands and draws air or water through the toe perforations **316** into the intake channel **304**. The air is then drawn through the intake valve **306** and into the depression **302** and open-cell foam **312**. When pressure is placed on the membrane **314**, air is expelled from the open-cell foam **312** and the depression **302**, through the exhaust channel **308**, through the exhaust valve **310**, and into the outside ambient air. The valve shown in FIG. **11** could be normal one-way air valves or could be molded flap valves as shown in FIG. **12**.

Referring now to FIG. **12**, there are illustrated flap valves. A single molded flap valve **320** has a single flap **322** which is pressed open from air passing in the direction of arrow **323**. If air were to try to attempt to pass in an opposite direction to the direction of the arrow **323**, the flap would be held shut and air would not be able to pass through the valve **320**. A dual molded flap **324** has two molded flaps **326** and **328**. When air is being pressed in the direction of arrow **327**, the flaps **326** and **328** are pushed open and air is allowed to pass. When air attempts to move in an opposite direction to the direction of the arrow **327**, the flaps **326** and **328** are pressed closed. The flaps **322**, **326** and **328** are molded using the same materials and at the same time that the midsole **300** was molded, and would eliminate the need to use separate valves as shown in FIG. **11**.

Referring now to FIG. **13**, there is an exploded view of a membrane pump with integrated intake. A top layer **320** is provided. The top layer **330** is in the shape of the sole of a human foot running the full length from heel to toe. Toe perforations **331** are provided in the area that would be under the human toes of the top layer **330**. A valve layer **332** is provided running from the end of the heel area approximately two-thirds of the distance to the toe area. The valve layer **332** has disposed in it an intake hole **336**. Disposed on top of the intake hole **336** is the flap valve **340**. The flap valve **340** is attached to the valve layer **342** such that the flap valve **340** lays directly over the intake hole **336**. Open-cell foam **338** is disposed between the valve layer **332** and the top layer **330**. Exit tube **342** is disposed in the rear of the foam **338** extending to the rear. The top layer **330** and valve layer **332** are welded together along the perimeter of valve layer **332**. The foam **338** and the exit tube **342** are captured in between the top layer **330** and the valve layer **332**. A bottom layer **344** is provided and is in the shape of the hole of a human foot. The bottom layer **344** runs the full distance from the heel to the toe area of the human shoe. The bottom layer **344** is then welded to top layer **330**. This leaves the forward one-third consisting of the bottom layer and the top layer without having foam in between and the rear two-thirds covered by the top layer **330**, the valve layer **332**, the foam **338**, and the bottom layer **344**. The weld between the top layer **330** and the valve layer **332** is an airtight weld forming an airtight cell around the foam **338** in exit tube **342**.

In operation, when no pressure is placed on top layer **330**, air is drawn through the toe perforations **331**, through the intake hole **336**, and then through the flap valve **340** into the open-cell foam **338**. When pressure is exerted on top layer **330**, air is expelled through the exit tube **342**.

In summary, there has been provided an air-cooled shoe operable to ventilate the interior of the shoe and the area around a human foot. An outer sole having a toe portion, a ball portion, and a heel portion is provided. A shoe upper is formed above the outer sole and is attached to the outer sole. A pump array is disposed above the ball portion of the outer sole. The pump array includes an airtight pump cell defined by a flexible material and filled with an open-cell material which causes the pump cell to expand and fill with air. The pump cell has an air intake disposed on the toe portion of the outer sole, and an air exhaust connected to the outside ambient air. A semirigid layer is disposed over the entirety of the pump array.

Although the preferred embodiment has been described in detail, it should be understood that various changes, substitutions and alterations can be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. An air-cooled shoe to be worn on a human foot operable to ventilate an interior of said shoe and the area around the human foot, comprising:

an outer sole having a toe portion, a ball portion and a heel portion;

a shoe upper formed above said outer sole and attached to said outer sole for surrounding the human foot;

said interior of said shoe defined to extend between said outer sole and said shoe upper;

a pump disposed under the human foot, said pump including an air-tight pump cell defined by a flexible material and filled with an expandable material which causes said pump cell to expand and fill with air, said pump cell having a pump intake having a first and a second end with said first end thereof connected to said pump cell, said pump cell also having a pump exhaust having a first and a second end with said first end thereof connected to said pump cell;

an air intake having a first and a second end, said air intake being mounted to said shoe such that said first end thereof is disposed proximate to said toe portion of the outer sole, inside said shoe upper, and in fluid communication with said interior of said shoe;

a first one-way valve having an inlet and an exhaust, said first one-way valve being mounted to said shoe such that said exhaust thereof is in fluid communication with the outside ambient air and said inlet thereof is in fluid communication with said second end of said pump exhaust so that air and liquid may flow only from said second end of said pump exhaust to the outside ambient air; and

a second one-way valve having an inlet and an exhaust, said second one-way valve being mounted to said shoe such that said exhaust thereof is in fluid communication with said second end of said pump intake and the inlet thereof is in fluid communication with said second end of said air intake so that air and liquid may flow only from said second end of said air intake to said second end of said pump intake.

2. The apparatus of claim **1**, wherein said first one-way valve and said second one-way valve are disposed in a pod which is detachably mounted to said outer sole.

3. The apparatus of claim **1**, wherein said expandable material comprises multiple layers of multiple materials.

4. The apparatus of claim **1**, wherein said exhaust of said first one-way valve is restricted, thereby regulating the release of air from said pump, causing said pump cell to collapse slowly.

5. The apparatus of claim **1**, wherein said pump is activated by the pressure of a human foot pressing against said pump cell and thereby compressing said pump cell, causing air to be expelled through said pump exhaust.

6. The apparatus of claim **1**, wherein said expandable material disposed within said pump cell comprises an open cell foam.

7. A method of ventilating the interior of the shoe and the area around the human foot, comprising:

drawing air from the interior of the shoe and into an air intake having a first and a second end, the first end of the air intake being disposed proximate to the toe portion of the outer sole, inside the shoe upper, and in fluid communication with the interior of the shoe;

pumping air from the air intake to the outside ambient air using a pump disposed under the human foot and mounted to the shoe, the pump including an air-tight pump cell defined by a flexible material and filled with an expandable material which causes the pump cell to expand and fill with air, the pump cell including a pump intake having a first and a second end with the first end thereof in fluid communication with the pump cell, and the second end of the pump intake in fluid communication with the interior of the shoe, the pump cell also having a pump exhaust having a first and a second end with the first end thereof connected to the pump cell;

allowing air and liquid to flow only from the second end of the pump exhaust to the outside ambient air using a first one-way valve having an inlet and an exhaust, the first one-way valve being mounted to the shoe such that the exhaust thereof is in fluid communication with the outside ambient air and the inlet thereof is in fluid communication with the second end of the pump exhaust; and

allowing air and liquid to flow only from the second end of the air intake to the second end of the pump intake using a second one-way valve having an inlet and an exhaust, the second one-way valve being mounted to the shoe such that the exhaust thereof is in fluid communication with the second end of the pump intake and the inlet thereof is in fluid communication with the second end of the air intake.

8. The method of claim **7**, and further comprising the step of disposing the first one-way valve and the second one-way valve in a pod which is detachably mounted to the other sole.

9. The method of claim **7**, wherein the expandable material comprises multiple layers of multiple materials.

10. The method of claim **7**, and further comprising the step of restricting the exhaust of the first one-way valve, thereby regulating the release of air from the pump, thereby providing a collapsing cushion.

11. The method of claim **7**, wherein the pump is activated by the pressure of a human foot pressing against the pump cell and thereby compressing the pump cell, causing air to be expelled through the pump exhaust.

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Appendix C
European Patent Application Number 1,074,193 to Opal Limited

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 074 193 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
07.02.2001 Bulletin 2001/06

(51) Int. Cl.[7]: **A43B 7/12**, A43B 7/06

(21) Application number: **99402866.0**

(22) Date of filing: **18.11.1999**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **04.08.1999 CA 2279738**

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(54) Ventilated footwear

(57) The ventilated footwear comprises a lower part incorporating a sole, an upper part coupled to the lower part and shaped to receive a foot of a wearer. The upper part has an arch portion and is provided with an inside surface adapted to permit air circulation therethrough, and an outside surface provided with ventilation holes located in the arch portion of the upper part of the footwear. A waterproof and breathable membrane is sandwiched between the inside and outside surfaces in the arch portion of the upper part of the footwear across the holes. Furthermore, an insole is preferably disposed into the footwear. The insole has an arch portion adjacently located to the arch portion of the upper part of the footwear. The upper layer of the insole is adapted to permit air circulation therethrough. The insole has a bottom layer provided with transverse intersecting channels extending inwardly from a peripheral edge of the insole. At least one of the channels is adjacent to the holes located in the arch portion of the outside surface of the upper part of the footwear. The channels are provided with openings in communication with the upper layer.

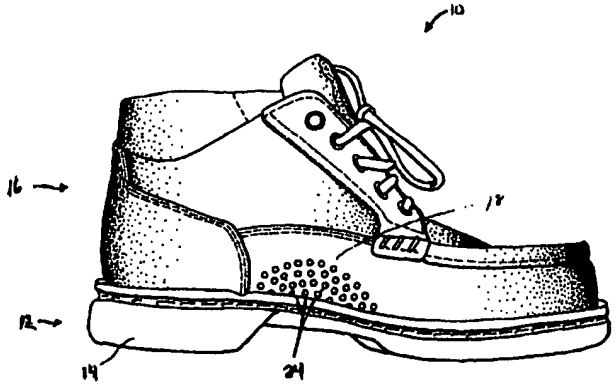

Fig 1

EP 1 074 193 A1

Description

Field of the Invention

[0001] The present invention relates to ventilated footwear. More specifically, the present invention relates to footwear having openings in the arch area of the upper, a waterproof and breathable membrane across said openings, and a compressible insole with openings in the top side in communication with channels on the underside which are in communication with the openings in the arch area of the upper for ventilating the interior of a footwear.

Background of the invention

[0002] Many kinds of footwear, such as athletic shoes, everyday walking shoes, and work boots have the drawback of poor ventilation. The inherent confining of the foot does not allow it to breathe, causing the foot to perspire and thereby promoting the development of bacteria, fungi and the like as well as the accompanying unpleasant odors and skin problems.

[0003] There have been various attempts to solve the problem of ventilating a shoe. A plethora of footwear constructions having various ventilation arrangements are known in the art. Openings in the upper are well known but suffer from the obvious problem of admitting debris and water. Complicated valve arrangements have been suggested by the prior art to close the opening. Many of the approaches have included a pumping means encased within the sole of the shoe, sometimes in communication with the openings in the upper. Generally, the weight of the foot is used to compress a bladder and force air out of apertures to ventilate the foot. Problems have also existed with failure of the bladder to reinflate. The shape and position of the bladder, or air pump, has been such that enough weight is always on it to prevent full inflation. Such mechanisms are typically prohibitively expensive to build into footwear and such complicated multi-component mechanisms are prone to failure and given that most of these prior art devices are built into the shoe, they are not easily repairable or replaceable.

[0004] There are also a variety of other solutions disclosed in order to improve ventilation, such as that disclosed in U.S. Patent No. 5,044,096. In this patent, the outsole is coupled to an insole, in which holes are traversing the thickness of the combined insole/outsole structure. The sole structure has a microporous, waterproof membrane disposed between the insole and the outsole, in order to allow the transpiration of the foot while keeping the foot dry. A primary disadvantage of that systems is that the openings to the exterior of the footwear are generally disposed a substantial part of the time against a surface, and such surface itself may be a source of hot air, for example hot road pavement. Another disadvantage with this solution is that since the holes for breathing are on the bottom of the outsole, the holes are often blocked by mud, dust or the like debris, resulting in the inefficient operation of the ventilation system.

Summary of the Invention

[0005] An article of footwear comprising:

- a lower part incorporating a sole,
- an upper part coupled to said lower part and shaped to receive a foot of a wearer, said upper part having an arch portion with a plurality of openings providing communication between the outside of the upper part and the interior of the upper part,
- a waterproof, breathable membrane across the openings, and
- a compressible insole with openings in the top side in communication with channels on the underside which are in communication with the openings in the arch area of the upper part,

  - for ventilating the interior of a footwear.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The present invention and its advantages will be more easily understood after reading the following non-restrictive description of preferred embodiments thereof, made with reference to the following drawings wherein:

Figure 1 is a perspective view of a preferred embodiment of the ventilated footwear according to the present invention.

Figure 2 is an exploded view of the arch portion of the footwear.

Figure 3 is an under view of the insole.

Figure 4 is a cross-sectional view of a insole operatively inserted within a footwear.

Figure 5 is a cross-longitudinal view of a channel communicating with the arch portion of the insole of Fig. 3 taken along the line V-V.

Figure 6 is a cross-view of the insole of Fig. 3 taken along the line VI-VI.

Figure 7 is a cross-view of the insole of Fig. 3 taken along the line VII-VII.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0007] With reference to figures 1 to 4, ventilated

footwear (10) according to the present invention comprises a lower part (12) incorporating a sole (14) , an upper part (16) coupled to the lower part (12) and shaped to receive a foot of a wearer. The upper part (16) may be of any type of footwear (an athletic shoe, a work boot, a hiking boot, etc.) and may be of any type of material (canvas, leather, synthetic leather, vinyl, plastic, etc.). These materials have a wide range of breathability, but often the construction of the upper part (16), particularly because of the use of adhesives, substantially reduce the breathability of the upper part (16).

[0008] The upper part (16) may also have a lining (20) to provide a comfortable interior surface to be in contact with the foot and/or sock of the wearer. Such linings are typically woven or non-woven textiles, and may have wicking properties. The upper part (16) may be treated with oils, silicone or the like to provide water resistant or water proof properties. Of course, such treatments usually interfere with the breathability of the material comprising the upper part. Waterproof and breathable membranes such as that sold under the GORE-TEX trademark are often also used on the inside of the upper part of footwear to provide water resistance with the intention of minimizing the interference with the breathability of the material comprising the upper part (16).

[0009] The upper part (16) has an arch portion (18) located on the medial side of the footwear. A plurality of openings (24) are located in the arch portion (18) of the upper part (16) of the footwear on the outside (22) thereof. The greater the number of openings (24) and the larger the openings (24) the greater degree of ventilation may be provided. The openings (24) may be arranged in almost any configuration to satisfy the aesthetic requirements of the design of the footwear. Typically, the openings (24) will be in the order of a few mm in diameter.

[0010] A waterproof, breathable membrane (26) larger than the area of the openings (24) is secured to the upper part (16) across the openings. The membrane (26) is preferably made of material such as the material known by the trademark GORE-TEX or another equivalent material. Such material allows air and water vapor to move across it, but does not allow water in liquid form to move across it. In the preferred embodiment of the invention, membrane (26) is secured to the interior (20) of the upper part (16) and may be secured between the upper part and any interior lining, although is contemplated that it may be secured to the exterior of the upper part (16). The membrane (26) may be secured by adhesive about the periphery or adhesive tape or stitched, although stitching may require the stitch holes to be sealed to ensure that the stitch holes do not admit water to the interior of the footwear.

[0011] The membrane may also be combined with a lining material which may be particularly advantageous when the membrane is to be disposed on the interior of the upper part with no liner between it and the foot (or sock over the foot) of the wearer.

[0012] Given the usual location and general configuration of the structure of the present invention, the membrane of the preferred embodiment is generally a half circle in shape as shown in Figure 2.

[0013] An insole (28) is preferably disposed into the footwear and it is preferably made of a resilient and compressible material, such as polyurethane, although EVA and other such materials may be used. The insole (28) is shaped to fit within the upper part and is contoured to provide a comfortable footbed for the foot of the wearer. Insoles of this type are well known, an example of one such footbed can be found in U.S. Patent No. Des. 290,423. The contouring of the insole includes an arch portion (30) which extends upwardly (see Fig. 4) to provide support and comfort for the medial arch of the foot of the wearer.

[0014] In the preferred embodiment of the invention, a plurality of openings (40) are provided substantially vertically through the thickness of the insole (28). As with the openings (24) in the upper part, the greater the number of openings (40) and the larger the openings (40) the greater degree of ventilation may be provided by the invention. The size and shape of the openings (40) are limited only to the extent that the support and comfort function of the insole (28) would be compromised. The openings (40) may be arranged in a variety of configurations, again with consideration of the support and comfort function of the insole in mind, and with consideration of the structure of the bottom side of the insole as discussed below.

[0015] In the preferred embodiment of the invention, a lining material (32) preferably made of a quilted textile such as the one known by the trademark CAMBRELLE is secured to the top surface in order to provide a comfortable surface for the foot of the wearer as well as air circulation and wicking properties. An alternative lining material such as kidskin leather may also be employed. In the case where a lining material such as the CAMBRELLE textile is employed, the openings (40) may not have to extend through the lining material; however, in the case where kidskin leather is employed, it is desirable that the openings (40) pass through the lining material in order to maximize breathability.

[0016] The bottom of the insole is provided with a plurality of substantially horizontal grooves or channels (36) in register with the substantially vertical openings (40) through the thickness of the insole (28) such that the channels (36) are in communication with the openings (40). The channels may be arranged in a variety of configurations with consideration of the location of the substantially vertical openings (40) through the thickness of the insole (28) as well as the support and comfort function of the insole (28) in mind.

[0017] The durometer of the insole (28) material, the thickness of the insole (28), and the depth of the channels (36) should be selected such that when a person walks or runs, the insole (28) should substantially

compress to provide a pumping action but allow the channels (36) to remain open in order to permit adequate air circulation. The weight of the wearer must, of course be taken into account in making such selections. Such selections are within the abilities of one of ordinary skill in the art and the ranges are not particularly different than that generally presently employed.

[0018] The plurality of channels (36) are arranged to be in communication with a plurality of channels (42) which extend to the upwardly extending arch portion (30) of the insole (see Fig. 4). These channels (42) are located so as to be in register with the openings (24) in the upper part. In an alternative embodiment of the invention, the channels (42) extending to the upwardly extending arch portion (30) of the insole may terminate in a cavity located in the upwardly extending arch portion (30) underside of the insole (28) and that cavity would be in communication the plurality of the openings (24) in the upper part.

[0019] As is apparent from a study of the structure shown and described, upon even the minimal almost imperceptible rocking a person experiences when standing still and even more so in the course of walking, the insole (28) compresses resulting in air being pumped through the channels (36) (42) and through the openings (24) in the upper part. As the wearer's foot is lifted off the ground, and the insole (28) expands to its uncompressed state, low pressure is created within the interior of the upper part and air is thereby drawn into the upper part through the openings (24) therein, through the channels (36) (42). Because of the properties of the membrane (26) across the openings, air carrying water vapor may pass out of the interior of the footwear and fresh air but not water in liquid state or debris may pass into the shoe. The openings (40) through the thickness of the insole permit the circulation of air to extend to that portion of the interior of the footwear above the insole and closer to the foot of the wearer.

[0020] The present invention may be provided to a footwear manufacturer or even a shoe repair facility as a kit comprising a template for the openings (24) in the upper part (16), an insole (28) constructed according to the invention and a membrane (26) with adhesive means. As mentioned herein, the present invention may be employed in wide variety of footwear types employing a wide variety of materials. The overall cost of adding the present invention to footwear is low compared to other ventilation schemes.

[0021] It should be understood that the present invention relates to a ventilated footwear (10) such as, regular shoes, athletic shoes, outdoor shoes, casual shoes, ski boots and fishing boots, where there is a need to ventilate the foot of a wearer, and is meant to include, but is not limited to: all categories of children's, women's and men's footwear; basketball, football, soccer, tennis, golf, bicycle shoes; skates (ice or inline); cowboy boots; work boots and shoes; military boots and shoes; nurse's, doctor's and other medical personnel's shoes.

[0022] Although the present invention has been explained herein above by way of a preferred embodiment thereof, it should be pointed out that any modification to this preferred embodiment within the scope of the present description is not deemed to alter or change the nature and scope of the present invention, as defined in the appended claims.

[0023] Furthermore, according to another aspect of the invention, the channels located on the bottom layer of the insole are transverse intersecting channels extending inwardly from the peripheral edge of the insole and at least one of the channels is adjacent to the holes located in the arch portion of the outside surface of the upper part of the footwear.

Claims

1. An article of footwear comprising:

   a lower part incorporating a sole,

   an upper part coupled to said lower part and shaped to receive a foot of a wearer, said upper part having an arch portion with a plurality of openings providing communication between the exterior of the upper part and the interior of the upper part,

   a waterproof, breathable membrane across the openings, and

   a compressible insole having a plurality of channels on the underside which are in communication with the openings in the arch area of the upper part.

2. The article of footwear according to claim 1, wherein said insole further comprises a plurality of substantially vertical openings in register and communication with said channels.

3. The article of footwear according to claim 1, wherein said insole further comprises a textile lining disposed on the upper side.

4. The article of footwear according to claim 1, wherein said insole further comprises a upwardly extending portion in the medial arch area.

5. The article of footwear according to claim 4, wherein said upwardly extending portion in the medial arch area has a plurality of channels in communication with one or more of said channels on the underside of said insole.

6. The article of footwear according to claim 5,

wherein said channels in said upwardly extending portion in the medial arch area are in register and communication with said openings in said upper part.

7. A kit for providing ventilation in an article of footwear, said kit comprising:

an insole,

an air permeable and water impermeable membrane,

adhesive means for securing said membrane to said article of footwear.

8. The kit of claim 7, further comprising a pattern for making openings in the upper part of said article of footwear.

9. The kit of claim 7, wherein said insole comprises a compressible material having a plurality of channels on the underside for communication with the openings in the arch area of the upper part of said article of footwear.

10. The kit of claim 9, wherein said insole further comprises a plurality of substantially vertical openings in register and communication with said channels.

11. The kit of claim 9, wherein said insole further comprises a textile lining disposed on the upper side.

12. The kit of claim 9, wherein said insole further comprises a upwardly extending portion in the medial arch area.

13. The kit of claim 12, wherein said insole wherein said upwardly extending portion in the medial arch area has a plurality of channels In communication with one or more of said channels on the underside of said insole.

14. The article of footwear according to claim 13, wherein said channels in said upwardly extending portion in the medial arch area are to register and communicate with openings in said upper part.

15. An article of footwear comprising:

a lower part incorporating a sole,

an upper part coupled to said lower part and shaped to receive a foot of a wearer,
said part being provided with a plurality of openings providing communication between the exterior of the upper part and the interior of the upper part, and a water proof, breathable membrane across the openings.

16. An article of footwear according to claim 15, wherein said openings are located in a predetermined area.

17. An article of footwear according to claim 16, wherein said article further comprises a compressible insole having a plurality of channels on the underside which are in communication with the openings in the upper part.

18. An article of footwear according to claim 17, wherein said insole further comprises a plurality of substantially vertical openings in register and communication with said channels.

19. An article of footwear according to claim 17, wherein said insole further comprises a textile lining disposed on the upper side.

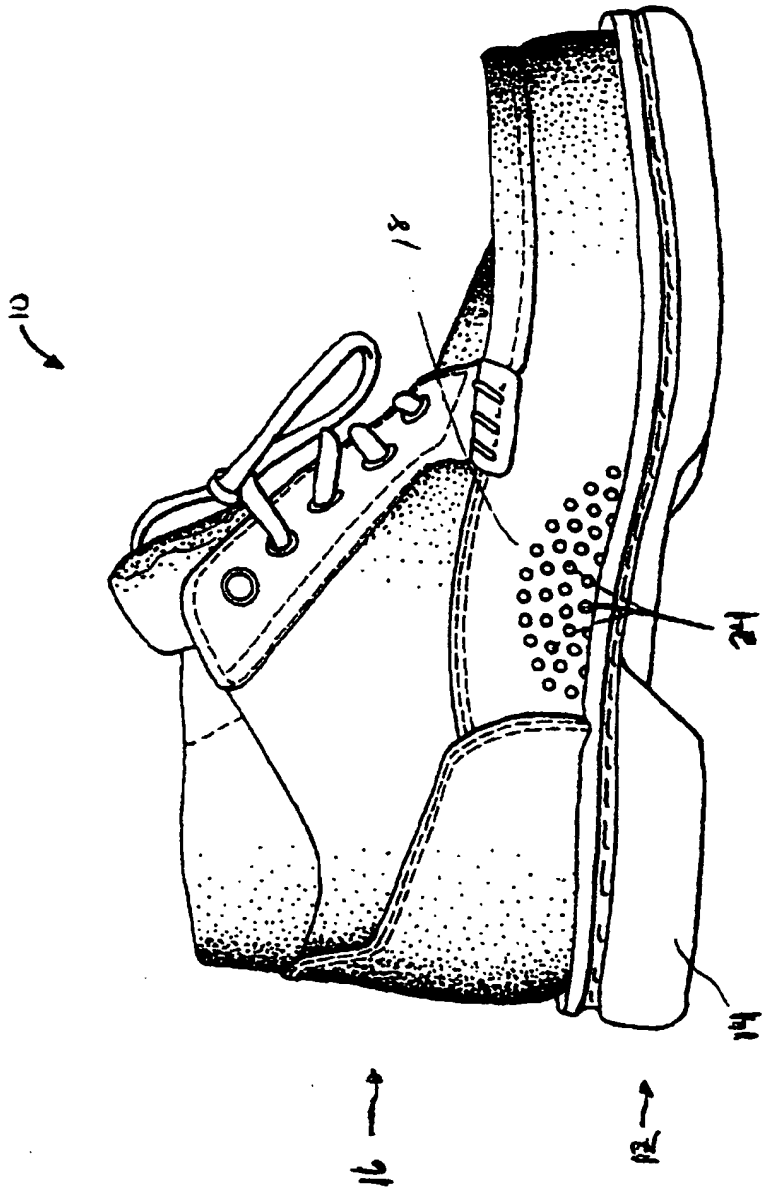

Fig 1

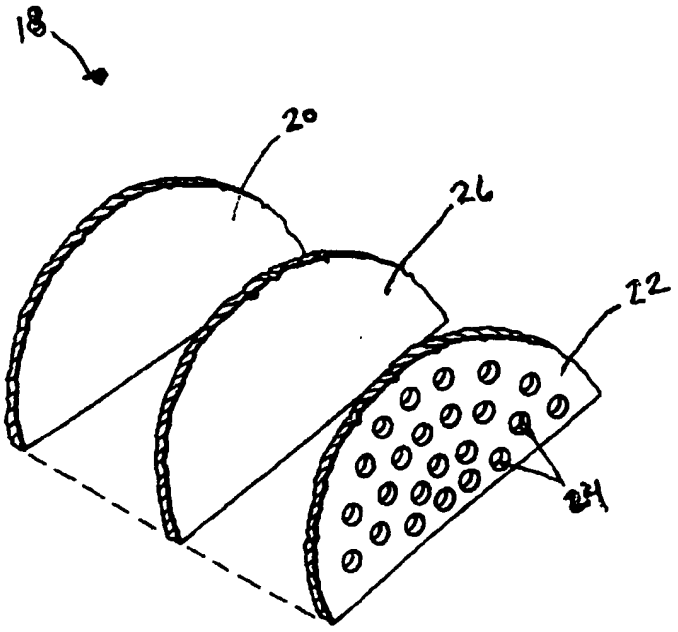

Fig 2

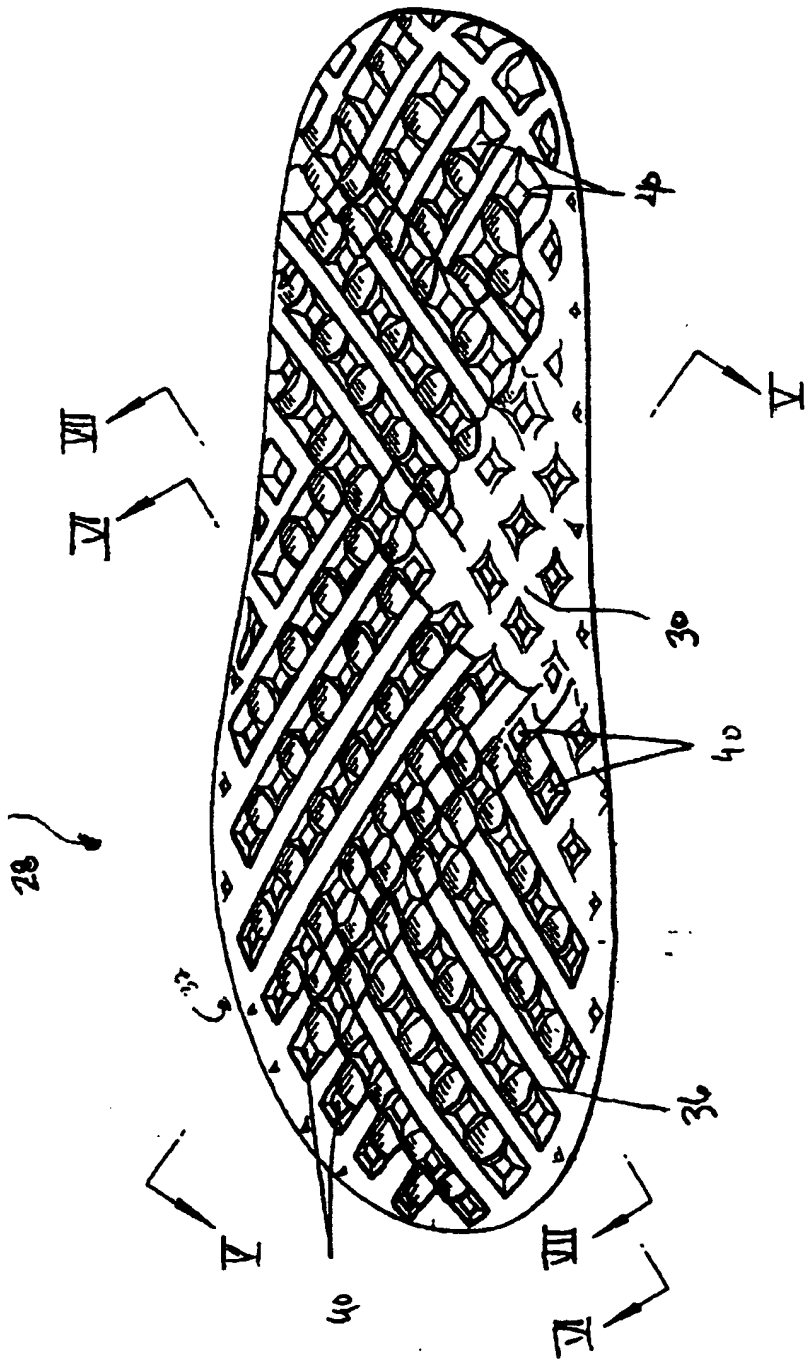

Fig 3

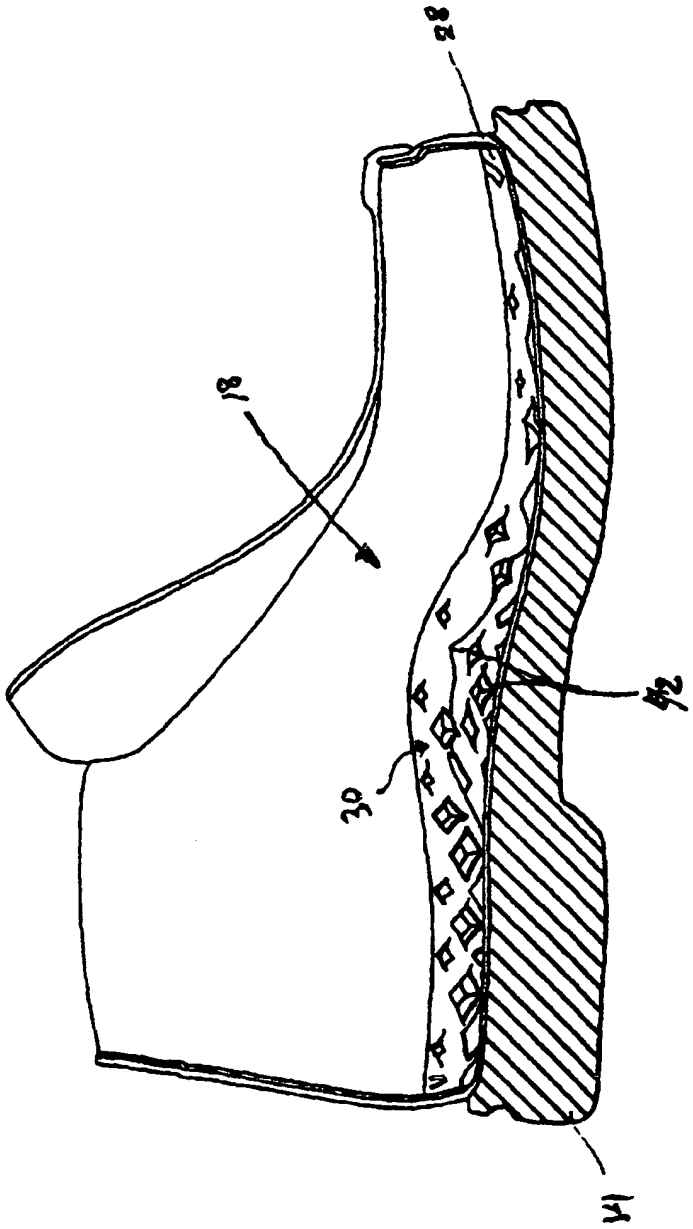

Fig 4

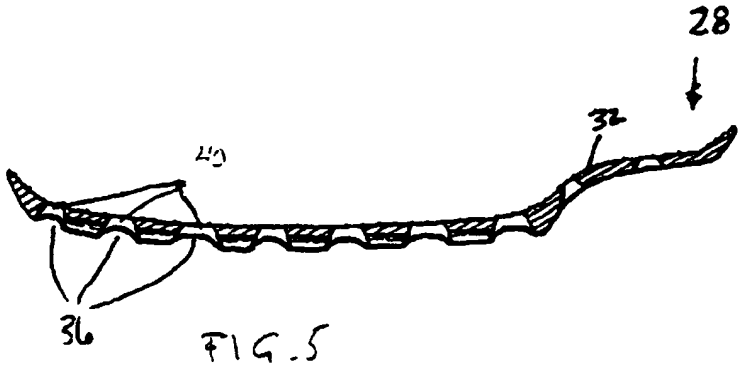

FIG. 5

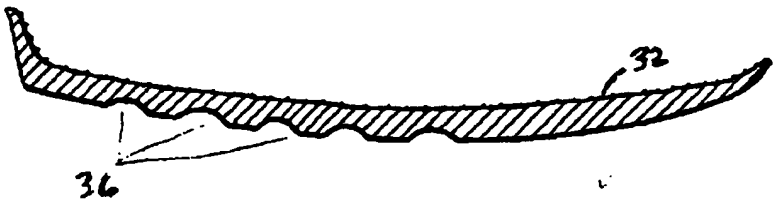

FIG. 6

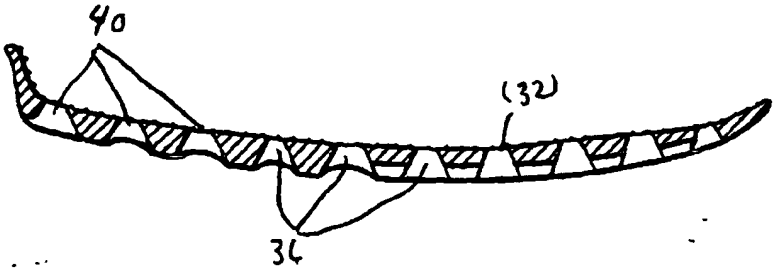

FIG. 7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 40 2866

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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Y	* the whole document *	1,2,4-6, 17,18	
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X	EP 0 437 869 A (LEE KYUN CHEOL) 24 July 1991 (1991-07-24) * the whole document *	1,2,4-6, 15-19	
X	EP 0 350 103 A (LEE KYUN CHEOL) 10 January 1990 (1990-01-10) * column 1, line 1 - line 8; claims; figures *	1,2,4-6, 15-19	TECHNICAL FIELDS SEARCHED (Int.Cl.7) A43B
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24 October 2000	Claudel, B

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 40 2866

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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24-10-2000

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

Appendix D
French Patent Application Number 2,670,369 to Colesnicenco Niculae
(Original and Translation)

(19) RÉPUBLIQUE FRANÇAISE

INSTITUT NATIONAL
DE LA PROPRIÉTÉ INDUSTRIELLE

PARIS

(11) N° de publication : **2 670 369**
(à n'utiliser que pour les commandes de reproduction)

(21) N° d'enregistrement national : **90 15663**

(51) Int Cl⁵ : A 43 B 7/06

(12) DEMANDE DE BREVET D'INVENTION A1

(22) **Date de dépôt** : 14.12.90.

(30) **Priorité** :

(43) **Date de la mise à disposition du public de la demande** : 19.06.92 Bulletin 92/25.

(56) **Liste des documents cités dans le rapport de recherche** : *Le rapport de recherche n'a pas été établi à la date de publication de la demande.*

(60) **Références à d'autres documents nationaux apparentés** :

(71) **Demandeur(s)** : *COLESNICENCO NICULAE* — FR.

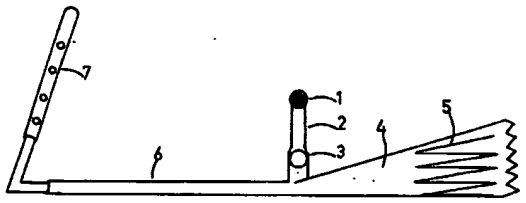
(72) **Inventeur(s)** : COLESNICENCO NICULAE.

(73) **Titulaire(s)** :

(74) **Mandataire** :

(54) Dispositif pour l'aération des pieds, par l'introduction de l'air frais, dans les chaussures fermées.

(57) L'invention concerne un dispositif qui produit un cycle de successions alternatives d'admissions et évacuations d'air frais utilisant la force mécanique du talon, produite pendant la marche. Il est pourvu de: filtre d'air (1), tuyau de liaison (2), soupape d'admission (3), soufflet (4) muni d'un ressort (5), tuyau d'évacuation (6), soupape (7) d'évacuation. Le soufflet (4) est soumis par le talon de l'utilisateur à l'admission de l'air frais alternant avec l'évacuation, grâce aux soupapes (3) et (7), qui font avancé l'air frais à l'intérieur de la chaussure. Le dispositif est destiné à l'industrie de la chaussure utilisé pour éliminer l'odeur déplaisante de la transpiration.



FR 2 670 369 - A1

DISPOSITIF POUR L'AERATION DES PIEDS, PAR L'INTRODUCTION DE L'AIR FRAIS, DANS LES CHAUSSURES FERMEES.

La présente invention concerne un dispositif conçu pour l'aérage des pieds dans des chaussures fermées.

Grâce à cette invention on réussit à éliminer totalement le désagrement de la transpiration.

Au point de vue des possibilités d'aérage , les chaussures , traditionnellement , sont soit découpées , soit munies des orifices latérals d'aération ou des pérforations , ces possibilités n'étant pas suffisantes pour supprimer l'indésirable transpiration.

Le dispositif selon cette invention permet de remédier cet inconvénient.

Ce dispositif peut être inclus dans le domaine téchnique de l'industrie du cuir et de la chaussure et, en même temps, il peut faire partie de la production des petites ateliérs.

Il est possible soit qu'on incorpore le dispositif dans l'anssamble de la chaussure, soit qu'on le confectionne à part et on l'intrpduise ultérieurement dans la chaussure traditionnelle.

Le dispositif selon l'invention comporte les élèments principaux suivants:

- un tuyau vertical d'aspiration prévu en haut d'un filtre;
- une soupape d'aspiration;
- un soufflet pourvu d'un ressort hélicoidal;
- un tuyau horizontal d'évacuation muni d'une soupape qui s'ouvre au moment d'arrivée de la valeur de la pression de l'air du tuyau orienté horizontalement jusqu'à la valeur établie par des calculs, ça se passant par augmentation

Selon les modalités particuliéres de la réalisation:

- la soupape d'admission peut faire partie soit du filtre, soit du tuyau d'admission - le tuyau vértical - soit du soufflet de ce dispositif;

- le soufflet peut être pourvu soit de deux ressorts latérals situés sur les deux côtés, la côté gauche et la côté droite, du soufflet, soit avec un ressort hélicoidal,situé centralement.

Les dessins annexés illustrent l'invention selon le mode suivant:

- la figure numéro 1 représente en coupe transversale le filtre du dispositif selon l'invention;

- la figure numéro 2 représente en coupe vérticale le tuyau d'aspiration et la soupape d'admission du dispositif selon l'invention;

- la figure numero 3 représente en coupe transversale le tuyau d'évacuation avec la soupape laquelle fonctionne à une pression constante et avant-détérminée, représenté avec les orifices d'évacuation de l'air de ventilation;

- la figure numéro 4 représente en coupe transversale le soufflet avec le ressort hélicoidal, à l'intérieur,mis en position centrale;

- la figure numéro 5 représente le dispositif désassemblé ;

- la figure numéro 6 représente en coupe transversale le dspositif selon l'invention;

- la figure numero 7 représente le dispositif selon l'invention vue d'en haut;

- la figure numero 8 représente la semelle en état de repos;

- la figure numero.9 représente la semelle tensionée par le talon.

En référence à ces dessins, le dispositif comporte:
le filtre d'air(1),situé au commençement du tuyau vertical d'admission(2),qui est pourvu intérieurement d'une soupape d'admission(3),laquelle est située en bas, tout prés du soufflet(4), le soufflet étant muni d'un ressort hélicoidal (5) situé centralement.

A la continuité du soufflet(4) se trouve le tuyau horizontal d'évacuation(6),prévu d'une soupape d'évacuation (7), ce tuyau se finissant avec des petits orifices (7c) d'évacuation de l'air, ainsi liberé avec pression.

Le filtre d'air(1),représenté dans la figure 1 comprend:

- un manchon du caoutchouc (1a) et un matériel filtrant (1b) comme feutre ou un autre matériel filtrant.

Le tuyau d'admision(2),représenté dans la figure numero 2, fait la liaison entre le filtre d'air(1)et la soupape d'admision(3).

Il est cofectionné du caoutchouc.

La soupape d'admission(3)est fixée à l'intérieur du tuyau vértical d'admission(2) et elle est confectionnée d'un mélange de caoutchouc et plastique.

Lasoupape(3)contient à l'intérieur un canal avec conicité (3a) et une bille de polystiren(3b).

Dés la soupape(3),représenté dans la figure numéro 2 ,dans le tuyau d'admission,commence le tuyau horizontal d'évacuation(6), muni à l'autre extrémité, de la soupape d'évacuation(7) et représenté avec la soupape et ses orifices dans la figure numéro 3.

La soupape (7) assure l'évacuation de l'air de ventilation à partir d'une valeur de la pression de l'air du tuyau horizontal (6) établie antérieurement.

Cette soupape présente un manchon de caoutchouc (7a),un orifice d'obturation(7b) et quatre orifices d'évacuation (7c).

Le tuyau horizontal d'évacuation(6) se fini avec ces orifices qui assurent la distribution de l'air de ventilation fourni par le systéme qui réalise le pompage artificiel et conduit l'air du niveau du talon jusqu'au niveau des doigts du pied.

Le soufflet(4),représenté dans la figure 4 ,est fermé et confectionné d'une surface caoutchoutée ou du caoutchouc mince, ayant fixé à l'intérieur un ressort hélicoidal(5)centrale et confectionné du fil d'acier. Ce ressort, en état de tension,pendant le fonctionement du système, s'enfouit dans la masse du soufflet.

Le principe de fonctionnement de ce dispositif est représenté par le pompage alternatif de l'air, produit par le mouvement du talon du pied pendant la marche.

Au début,le soufflet(4) se trouve en état de repos et il est rempli de l'air dans son volume entier.

C'est la situation qui caractérise l'état avant de l'introduction du pied dans la chaussure munie de ce dispositif.

Au moment de l'introduction du pied dans cette chaussure, le ressort(5) est mis en état de tension et il provoque la diminution du volume du soufflet (4). Encet état,l'air du soufflet(4)est poussé avec pression.

Il ferme la soupape d'admission(3) et il prend la direction permise, du tuyau d'évacuation(6),aprés il recontre la soupape d'évacuation(7)qui s'ouvre au moment où la valeur de la pression de l'air du tuyau (6),en augmentant, arrive à la valeur obtenue par des calculs.

Au moment de la levée du pied pendant la marche, le ressort(5) se détend grâce à l'energie potentielle accumulée antérieurement, enétat de tension, le volume du soufflet commence à augmenter et, à la suite,il a lieu la création d'une dépression dont l'effet c'est l'aspiration de l'air frais et filtré par l'ouverture de la soupape d'admission.

Le soufflet s'est ainsi rempli de l'air de ventilation et, quand le talon descend , il exerce une pression sur celui-ci, par laquelle détermine la diminution de son volume et la fermeture de la soupape d'admission(3)

L'air de ventilation est obligé de suivre la direction du tube d'évacuation(6) et il arrive à la soupape(7),. .-cette condition étant concrétisé dans la nécessité de surmonter la résistence opposée par le manchon de caoutchouc(7a),résistence dont la valeur est choisie relativement à la valeur de la pression de l'air avant-determinée.

Ces calculs sont déterminés d'un certain façon pour que la soupape(7)d'évacuationpuisse éliminer l'air de ventilation à une pression d'une valeur plus élevée, ayant comme but la provocation d'une élimination forcée du l'air propre et frais qui pousse à l'extérieur l'air vicié.

Les quatre orifices d'aération (7c) sont placés entre tous les deux doigts du pied pour assurer une aire de diffusion , une extension suffisante de l'effet de ventilation.

À titre d'exemple non-limitatif , les dimensions peuvent être les suivantes :

- le diamètre des tuyaux d'admission (2) et d'évacuation (6) de 5 mm ;

- le diamètre du fil d'acier du ressort hélicoidal (5) d'un mm ;

Toutes les autres dimensions sont variables en fonction de la grandeur de la chaussure .

REVENDICATIONS

1.- Dispositif pour écarter entiérement,par venti - lation , l'effet ennuyeux de la transpiration des pieds dans des chaussures fermées, caractérisé en ce qu'il comporte un filtre (1) , continué par un tuyau vértical d'admission (2) , pourvu d'une soupape d'admission (3) , laquelle assure , par son fonctionnement la pénétration de l'air de ventilation dans le système et d'où commence le tuyau horizontal d'évacuation(6)muni de la soupape d'évacuation(7) et de quatre orifices d'évacuation, dispositif caractérisé en ce qu'il comporte aussi le soufflet (4) , prévu à l'intérieur d'un ressort hélicoidal (5),lequel produit la variation du volume du soufflet et de la pression de l'air qui se trouve à l'intérieur du système .

2. -Dispositif selon la revendication 1 , caractérisé en ce que le filtre (1) est placé à l'extrémité supérieure du tuyau vértical (2).

3. -Dispositif selon les revendications 1 et 2,carac - térisé en ce que , la soupape (3) est munie d'une bille (3b) située dans un canal avec conicité (3a) .

4. -Dispositif selon l'une quelconque des revendi - cations précédentes , caractérisé en ce que le soufflet (4) présente un ressort hélicoidal (5) , confectionné d'un fil d'acier qui s'enfouit dans la masse du soufflet quand il est mis en état de tension .

5. -Dispositif selon l'une quelconque des revendi - cations précédentes caractérisé en ce que la soupape (7a) est pourvue d'un manchon de caoutchouc qui assure son fonctionnement en rélation avec la pression , elle s'ouvrant à une valeur détérminé de la pression à laquelle s'était prévu que l'air puisse s'évacuer .

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FIG 1

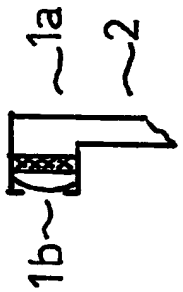

FIG 2

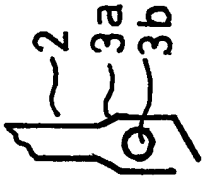

FIG 3

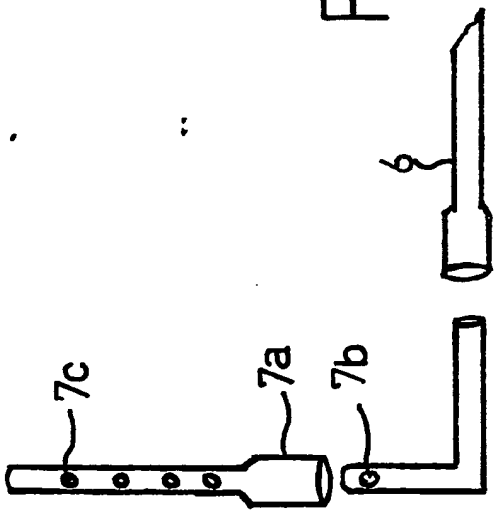

FIG 4

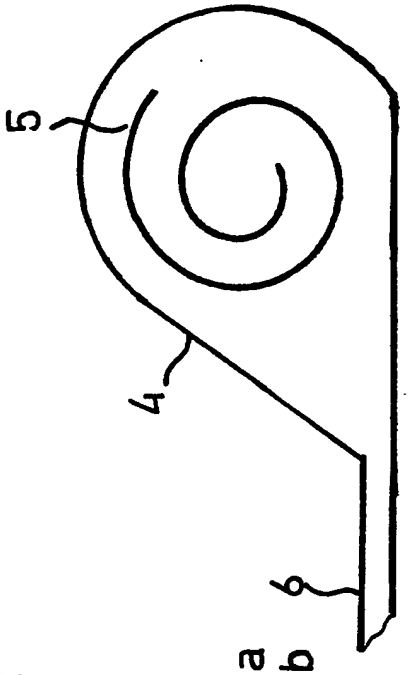

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FIG5

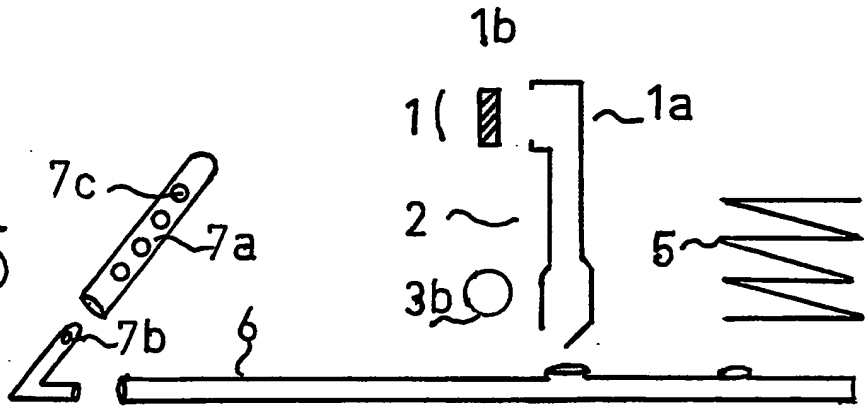


FIG6

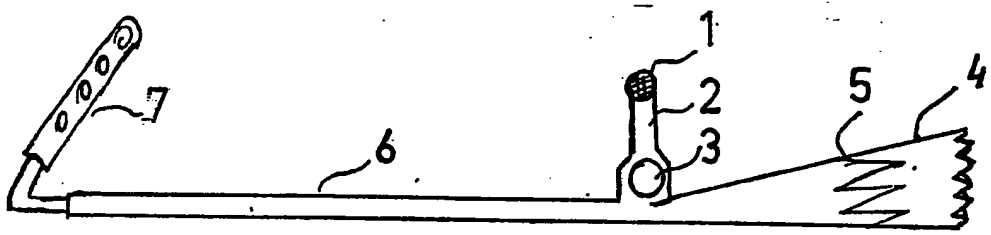


FIG7

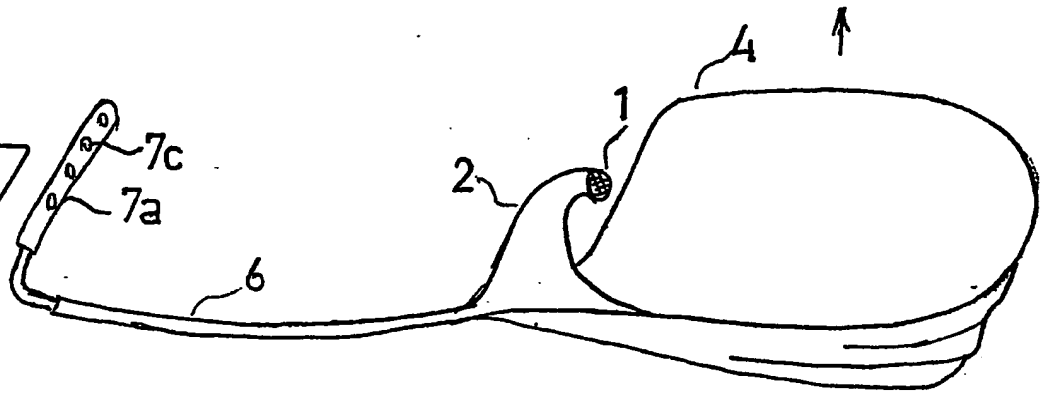


FIG8

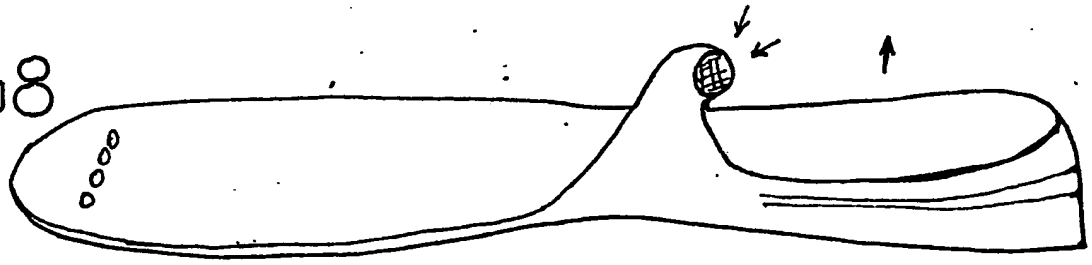
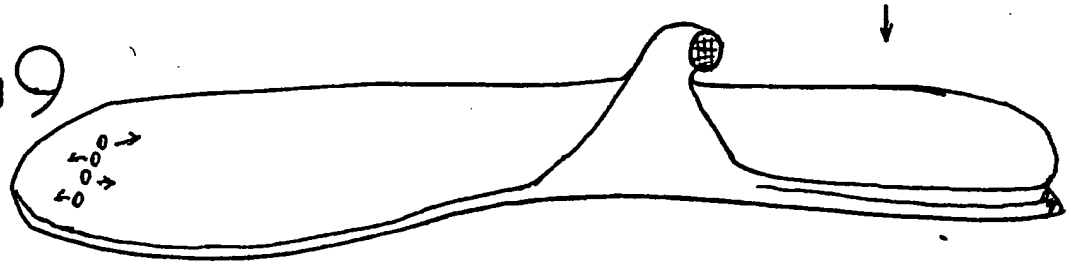


FIG9



French Patent Application No. 2 670 369 A1

Job No.: 2397-88789 Ref.: 005127.00094
Translated from French by the Ralph McElroy Translation Company
910 West Avenue, Austin, Texas 78701 USA

FRENCH REPUBLIC
NATIONAL INSTITUTE OF INDUSTRIAL PROPERTY
PATENT APPLICATION NO. 2 670 369 A1

Int. Cl.^{5}:	A43B 7/06
Filing No.:	90 15663
Filing Date:	December 14, 1990
Date of Public Access to the Application:	June 19, 1992 Bulletin 92/25

DEVICE FOR VENTILATION OF THE FEET BY INTRODUCTION OF FRESH AIR INTO CLOSED SHOES

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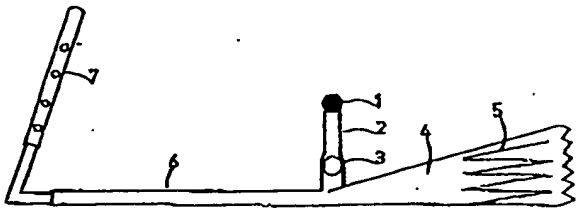
Applicant:	Colesnicenco Niculae

Abstract:

The invention concerns a device that produces a cycle of alternating successions of intakes and discharges of fresh air using the mechanical force produced by the heel during walking. It is provided with air filter (1), connecting tube (2), intake valve (3), bellows (4) provided with a spring (5), discharge tube (6), discharge valve (7). The bellows (4) is subjected by the heel of the user to the intake of fresh air alternating with its discharge, as a result of valves (3) and (7) which cause the fresh air to advance within the shoe. The device, designed for the shoe industry, is used for removing unpleasant odor produced by sweating.



The present invention concerns a device designed for ventilating the feet in closed shoes.

As a result of this invention total removal of the unpleasantness from sweating is successfully achieved.

From the point of view of ventilation possibilities, traditionally shoes are either cut out or provided with lateral ventilation orifices or perforations, these possibilities not being sufficient to eliminate undesirable sweating.

The device according to this invention allows this drawback to be remedied.

This device may be included in the technical field of the leather and shoe industry and at the same time, it may be part of the production of small workshops.

It is possible either for the device to be incorporated in the shoe assembly or to be introduced later into a traditional shoe.

The device according to the invention includes the following principal elements:

- a vertical intake tube provided at the top with a filter
- an intake valve
- a bellows provided with a helical spring
- a horizontal discharge tube provided with a valve which is opened when the air pressure value in the horizontally oriented tube reaches the value established by calculation, this happening by increase

According to the specific methods of the embodiment:

- the intake valve may either be part of the filter or intake tube – the vertical tube – or of the bellows of this device;
- the bellows may either be provided with two lateral springs located on the two sides, the left side and the right side of the bellows, or with a helical spring, located centrally

The attached drawings illustrate the invention according to the following method:

- Figure 1 represents the cross section of the filter of the device according to the invention;

- Figure 2 represents the vertical section of the intake tube and the intake valve of the device according to the invention;

- Figure 3 represents the cross section of the discharge tube with the valve that functions at a constant and predetermined pressure, represented with the discharge orifices for the ventilation air;

- Figure 4 represents the cross section of the bellows with helical spring, inside, placed centrally;

- Figure 5 represents the disassembled device;

- Figure 6 represents the cross section of the device according to the invention;

- Figure 7 represents the device according to the invention viewed from above;

- Figure 8 represents the sole in the state of rest;

- Figure 9 represents the sole tensioned by the heel.

In reference to these drawings, the device includes the air filter (1) located at the beginning of the vertical intake tube (2) that is provided inside with an intake valve (3) located at the bottom, very near the bellows (4), the bellows being provided with a helical spring (5) located centrally.

At the continuation of the bellows (4) is found the horizontal discharge tube (6) provided with a discharge valve (7), this tube finishing with small orifices (7c) for the discharge of air, thus liberated under pressure.

The air filter (1) represented in Figure 1 consists of:

- A rubber sleeve (1a) and a filtering material (1b) such as felt or another filtering material.

The intake tube (2) represented in Figure 2, connects the air filter (1) with the intake valve (3).

It is made of rubber.

The intake valve (3) is attached to the interior of the vertical intake tube (2) and is made from a mixture of rubber and plastic.

The valve (3) contains on the interior a tapering channel (3a) and a polystyrene bead (3b).

The horizontal discharge tube (6) begins from the valve (3), represented in Figure 2, in the intake tube; it is provided on the other end with the discharge valve (7) and represented with the valve and its orifices in Figure 3.

The valve (7) ensures the discharge of ventilation air starting from a pressure value of the air in the horizontal tube (6), established beforehand.

This valve has a rubber sleeve (7a), a sealing orifice (7b) and four discharge orifices (7c).

The horizontal discharge tube (6) ends with these orifices that ensure the distribution of ventilation air provided by the system that carries out the artificial pumping and conducts the air from the heel to the toes.

The bellows (4) represented in Figure 4 is closed and made with a rubberized surface or thin rubber, with a central helical springs made from steel wire attached within. This spring, in a state of tension during operation of the system, is buried in the mass of the bellows.

The operating principle of this device is represented by alternating pumping of the air produced by the movement of the heel of the foot during walking.

At the beginning, the bellows (4) is found in a state of rest and its entire volume is filled with air.

This is the situation that characterizes the state before the introduction of the foot into the shoe provided with this device.

At the moment of introduction of the foot into this shoe, the spring (5) is put in a state of tension and the volume of the bellows (4) is caused to decrease. In this state, the air from the bellows (4) is pushed under pressure.

This closes the intake valve (3) and it takes the direction allowed, from the discharge tube (6) after it meets the discharge valve (7) that opens at the moment when the value of the air pressure of the tube (6), while increasing, arrives at the value obtained by calculation.

When the foot is lifted during walking, the spring (5) is extended as a result of the potential energy accumulated previously in a state of tension, the volume of the bellows begins to increase, and subsequently the creation of a vacuum takes place in which the effect is the intake of fresh and filtered air by opening the intake valve.

The bellows is thus filled with ventilation air and when the heel descends, it exerts a pressure on the latter, by which the decrease in its volume and closing of the intake valve (3) is determined.

The ventilation air is obligated to follow the direction of the discharge tube (6) and it arrives at the valve (7), small gap indicating possible omission this condition being realized with the necessity of overcoming the opposing resistance by the rubber sleeve (7a), resistance wherein the value is chosen relative to the value of the predetermined air pressure.

These calculations are determined in a certain way so that the discharge valve (7) can eliminate the ventilation air at a pressure with a higher value, having the goal of provoking a forced elimination of the clean and fresh air, which pushes the contaminated air to the outside.

The four ventilation orifices (7c) are placed between both toes of the foot to ensure an area of diffusion, a sufficient extension of the ventilation effect.

By way of nonlimiting example, the dimensions may be the following:

- diameter of the intake tube (2) and discharge tube (6) of 5 mm;

- diameter of the steel wire of the helical spring (5) of 1 mm;

All other dimensions are variable according to the size of the shoe.

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FIG 1

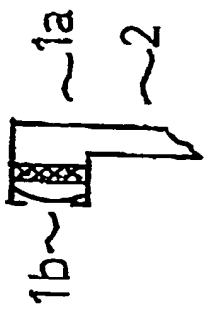

FIG 2

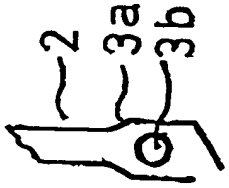

FIG 3

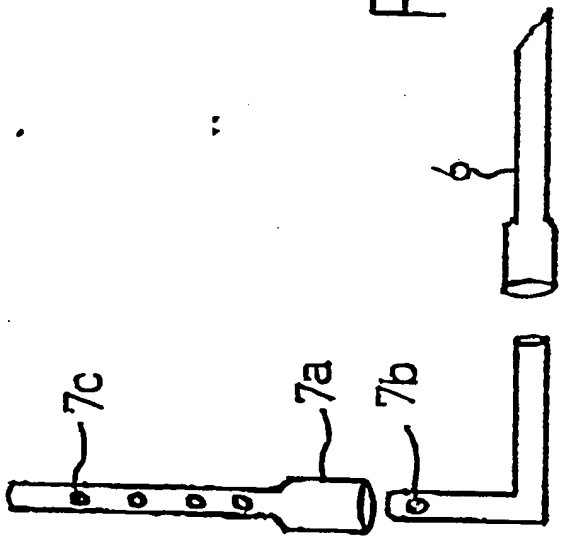

FIG 4

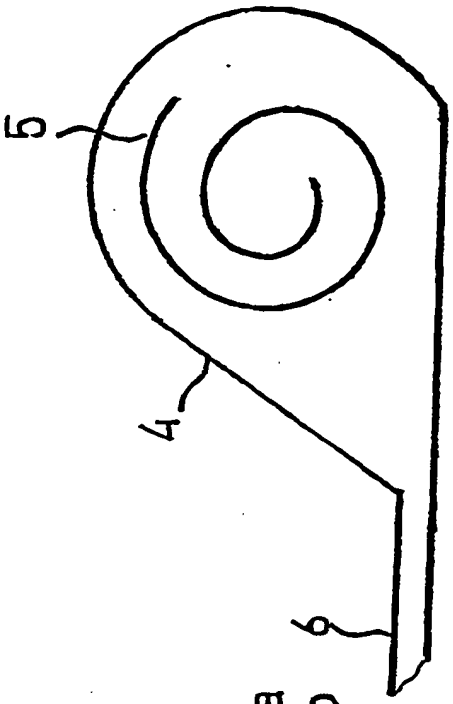

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FIG5

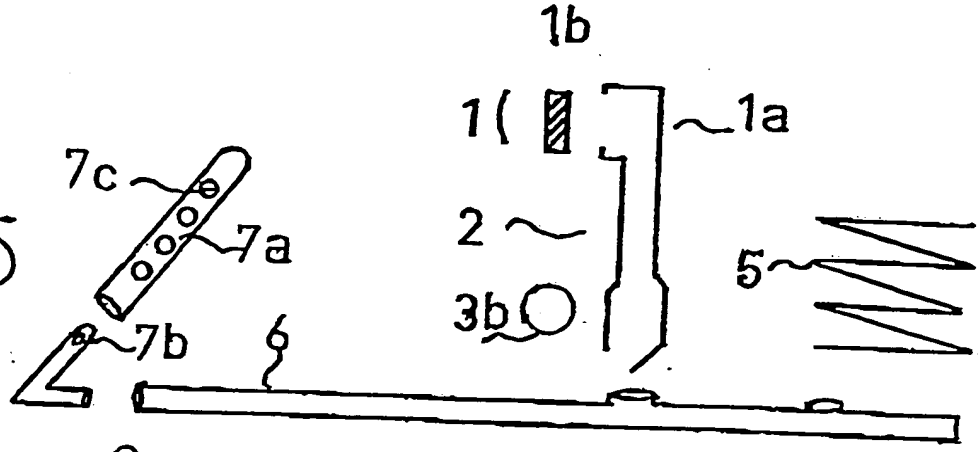


FIG6

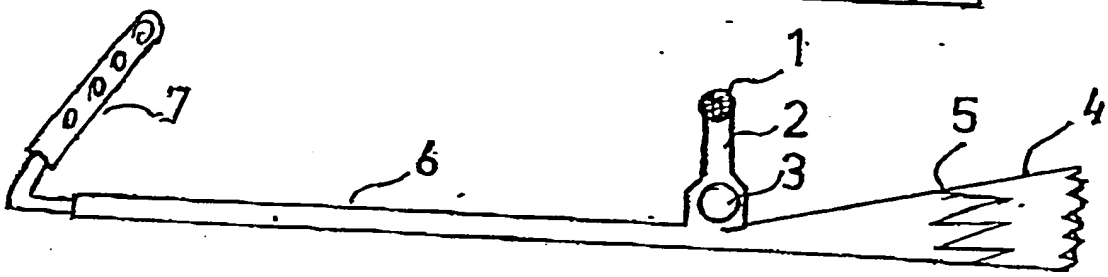


FIG7

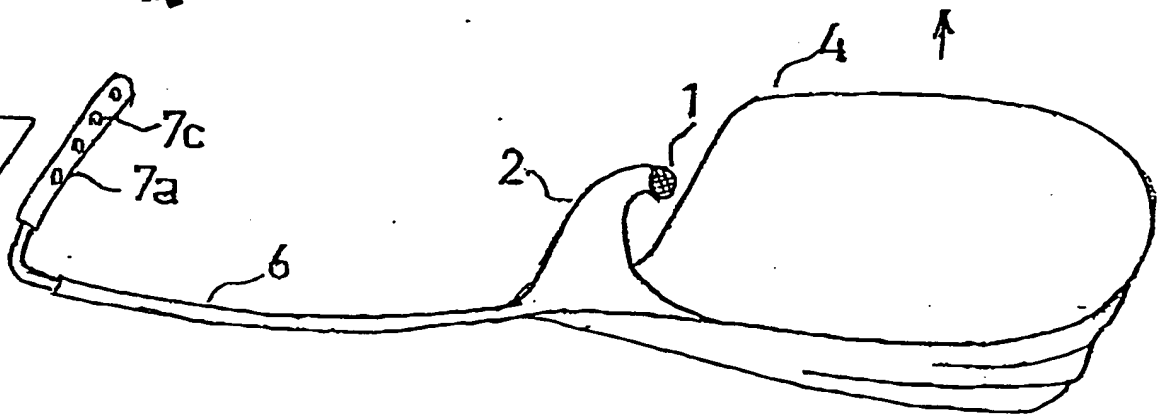


FIG8

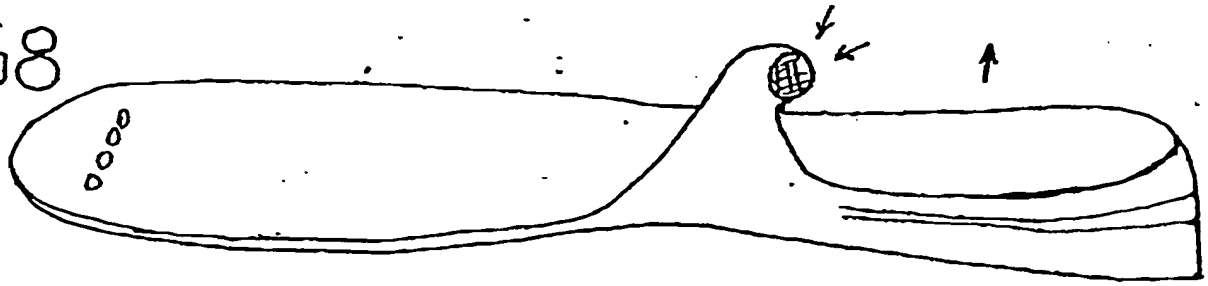
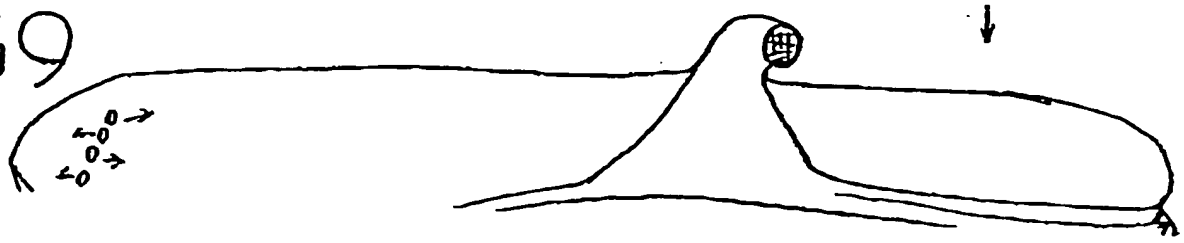


FIG9



Appendix E
Figures From U.S. Patent Application Serial Number 09/887,523

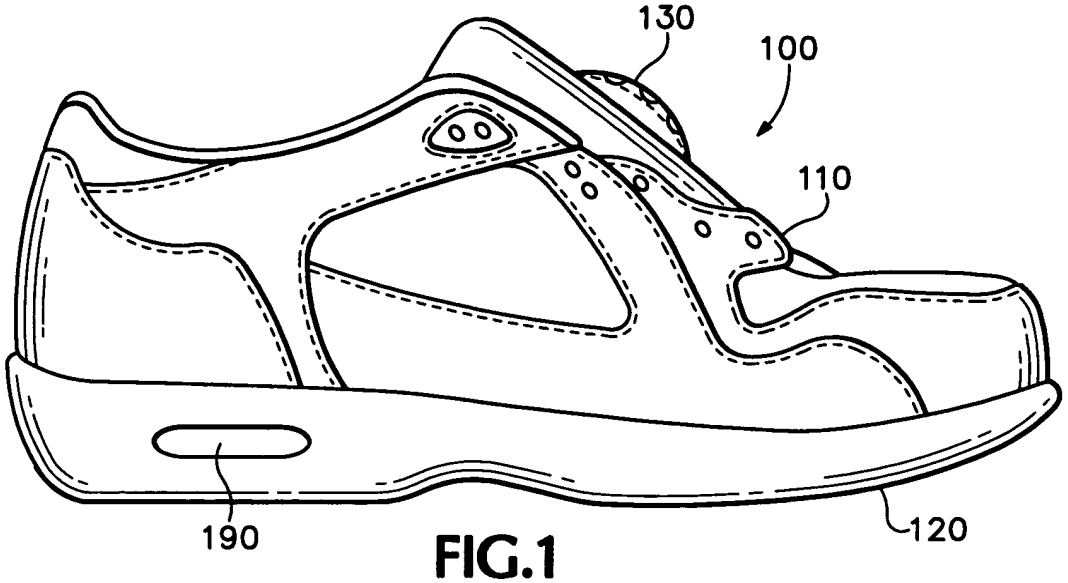

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FIG.1

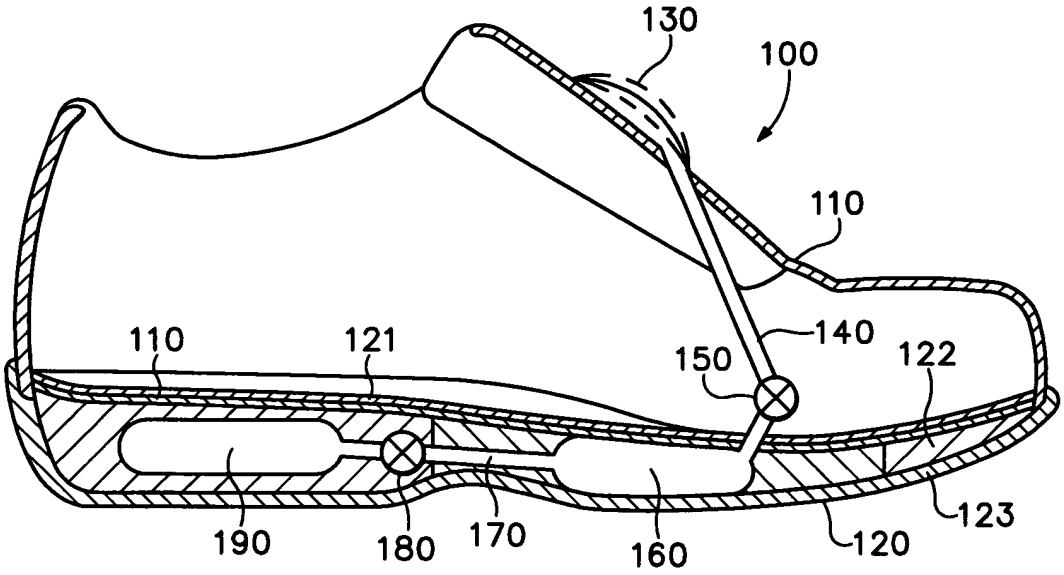
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FIG.2

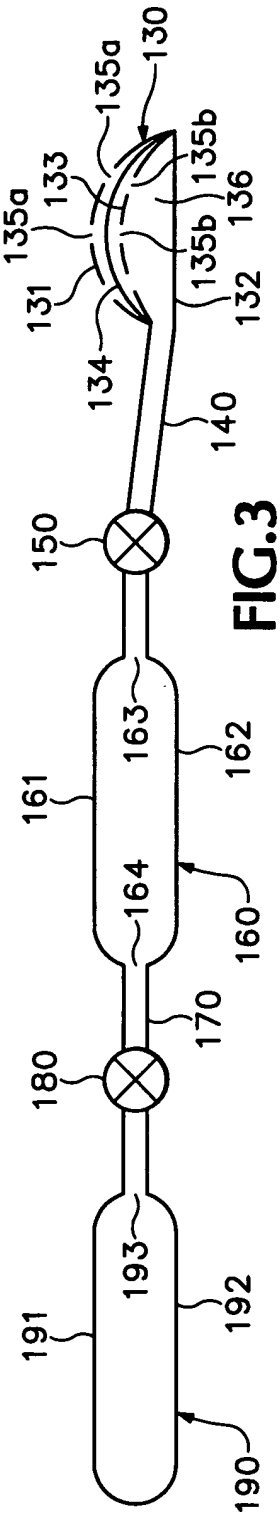
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FIG.3

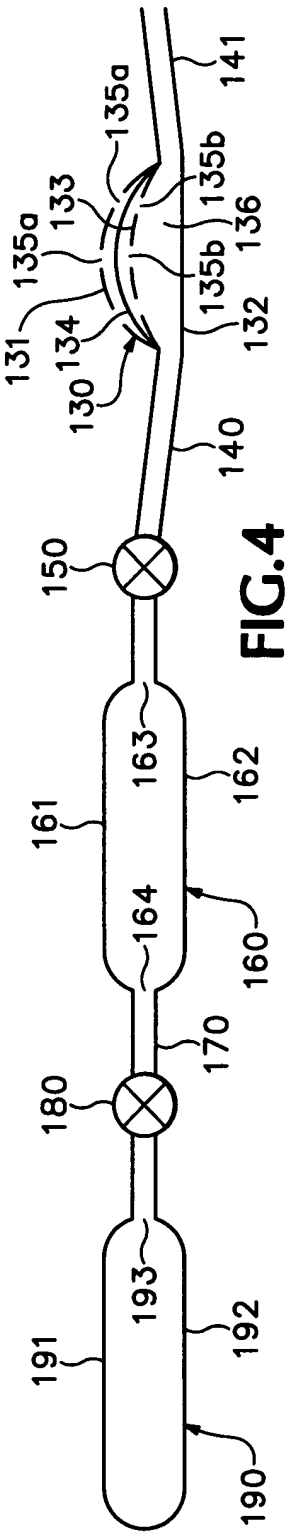
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FIG.4

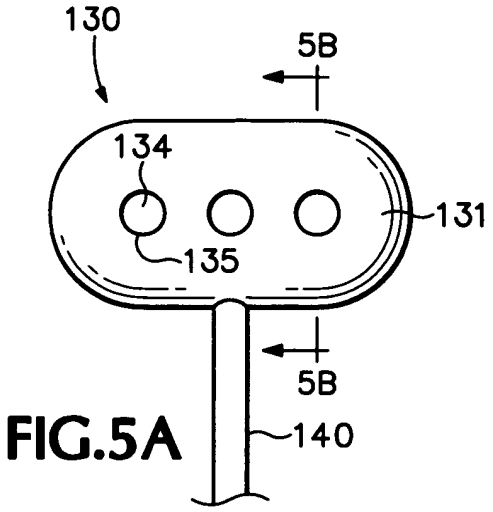

FIG.5A

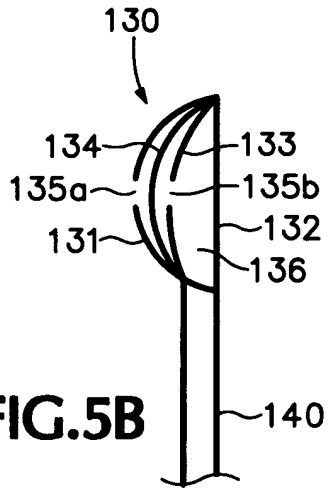

FIG.5B

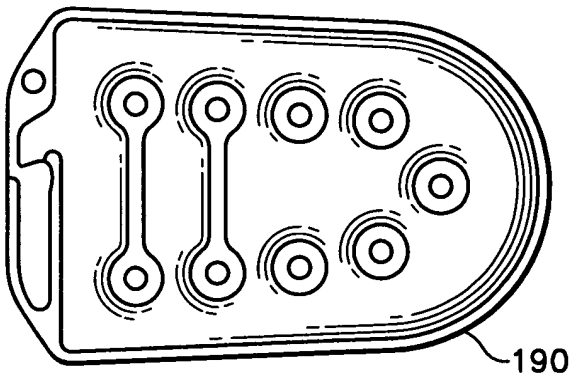

FIG.5C

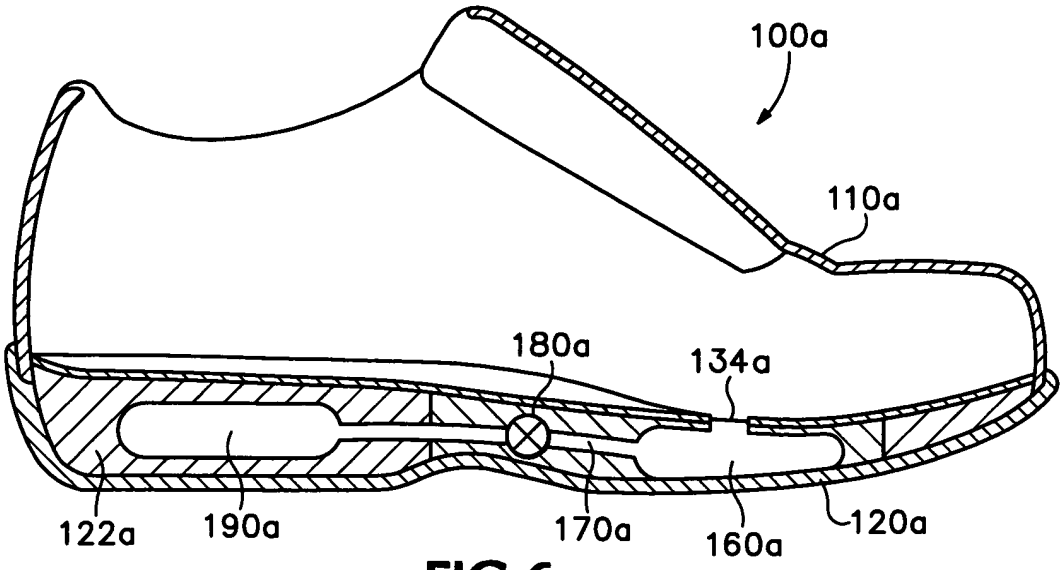
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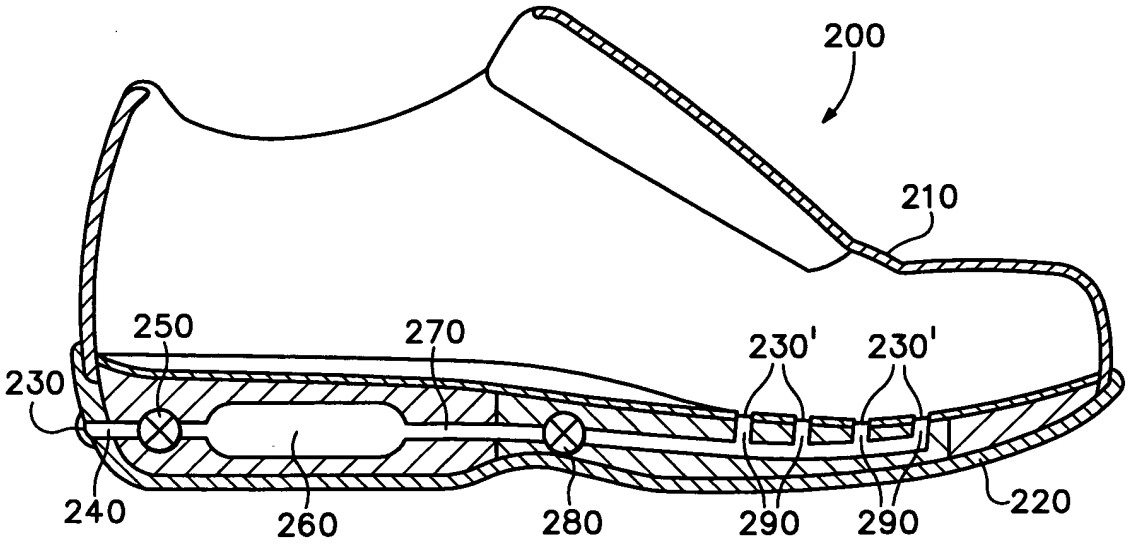
FIG.6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210
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230'
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240
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220

FIG.7